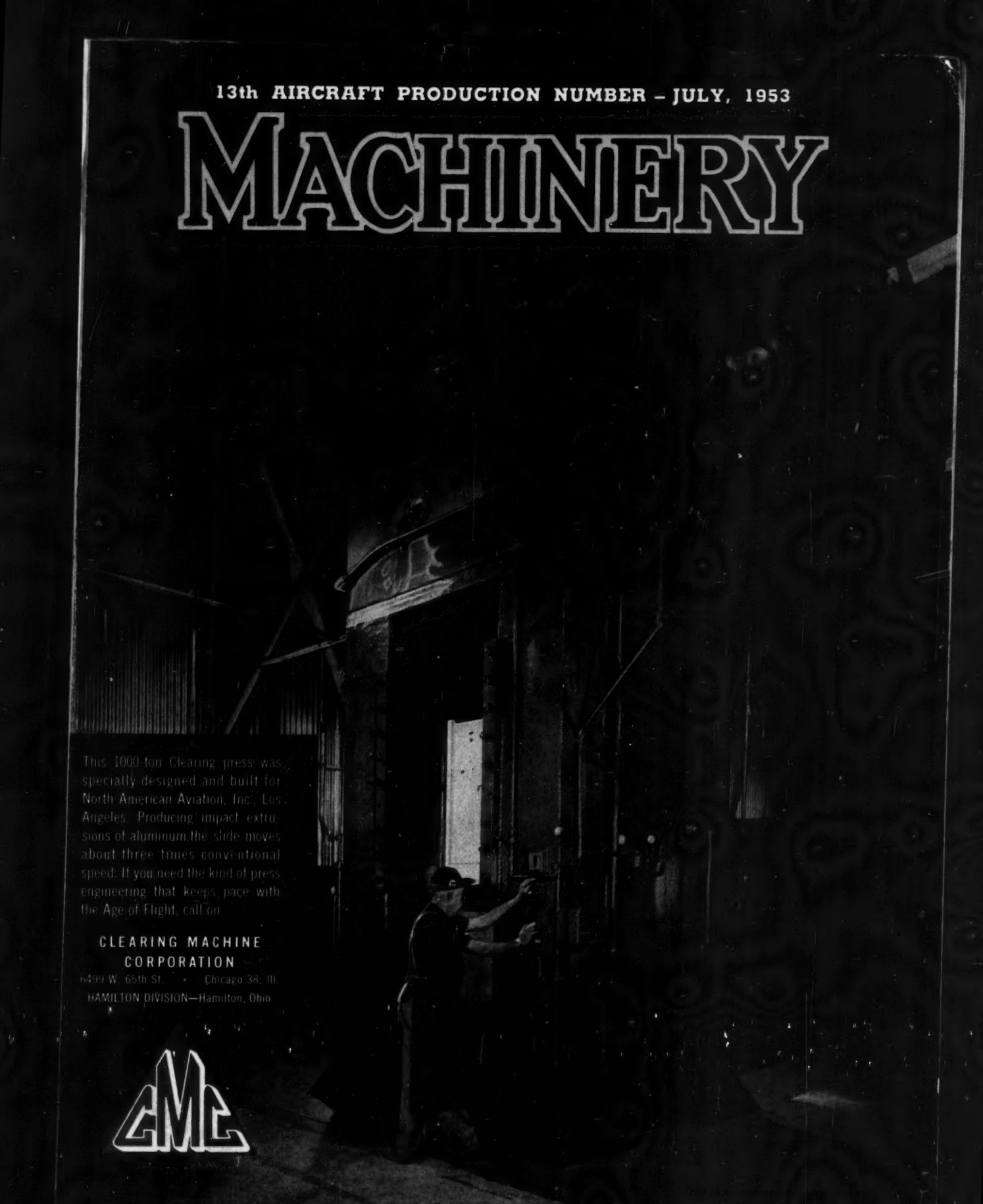
13th AIRCRAFT PRODUCTION NUMBER – JULY, 1953

MACHINERY



This 1000-ton Clearing press was specially designed and built for North American Aviation, Inc., Los Angeles. Producing impact extrusions of aluminum, the slide moves about three times conventional speed. If you need the kind of press engineering that keeps pace with the Age of Flight, call on

CLEARING MACHINE CORPORATION
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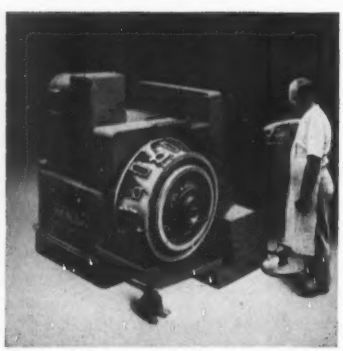
CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

Jet Aircraft Part Gets

40 BORIZING OPERATIONS *in 12 minutes*



MAKING DIFFICULT JOBS easy is a Heald specialty. Here's a typical example.

Eight circular flanges on this jet-engine compressor frame require *five* individual borizing operations to very close tolerances. Yet with the Heald way-type Bore-Matic shown at the left, the entire job—including loading and unloading—takes only 12 minutes per part.

The number 3 size way leg unit, with rotary fixture mounted low on the base, simplifies loading of the heavy, awkward part. The rotary fixture is manually indexed and positioned by an air-operated locator pin with foot-valve control. Operations performed include chamfering, turning, facing, forming and blending two radii. Borizing operations at each of the eight positions are completely automatic.

Remember, when it comes to precision finishing, it pays to come to Heald.

Internal and Rotary
Surface Grinding Machines
and Bore-Matics

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MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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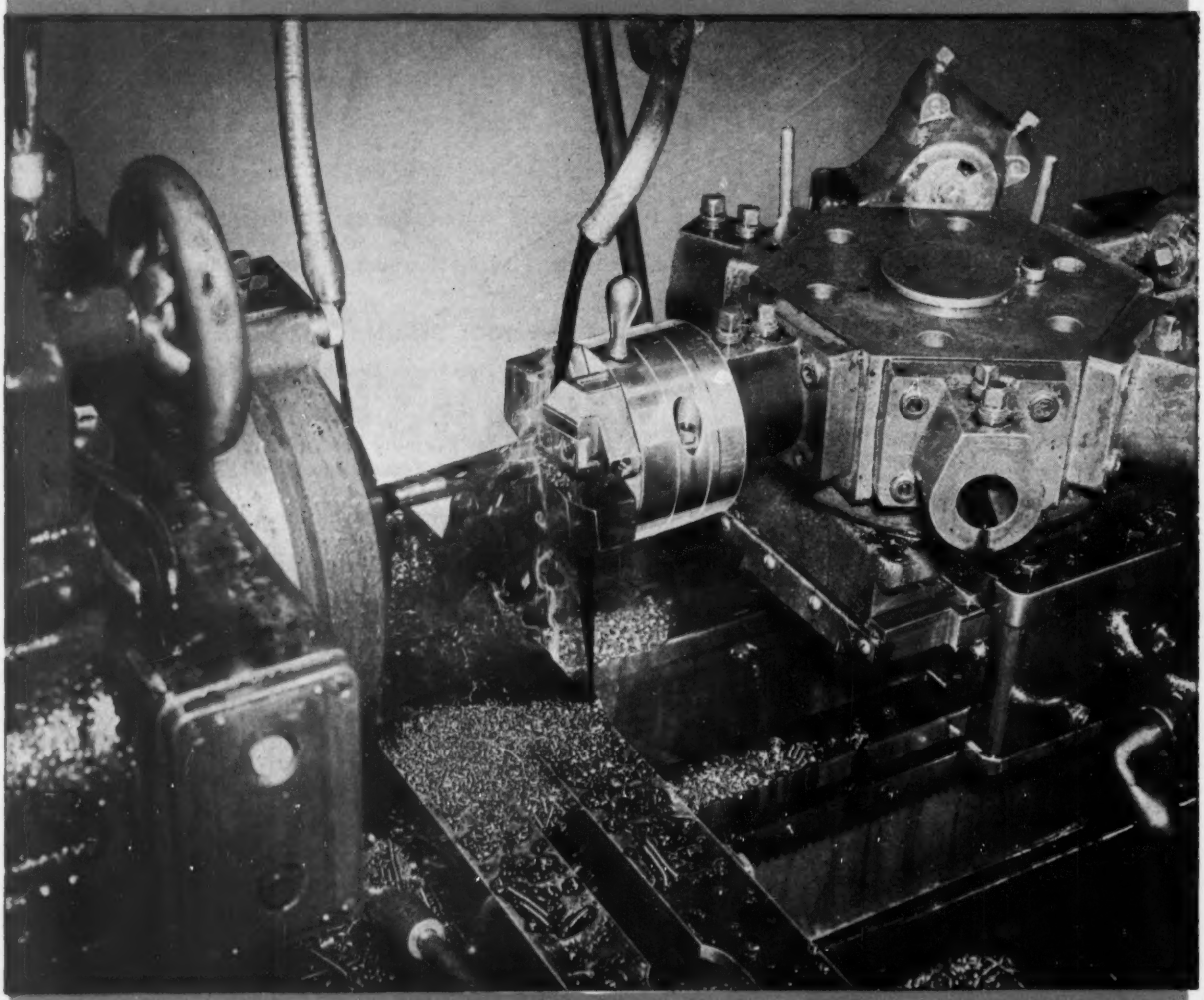
LANDMATIC

Reduces Cost by



. . . . THE WORLD'S LARGEST EXCLUSIVE

HEAD 75%

Large savings on threading operations have been realized through the use of LANDMATIC Heads by Scott Aviation Corporation, an aircraft equipment manufacturer. These savings are made possible by great reductions in machining time and by quicker product assembly resulting from improved thread quality.

In producing Stabilizer Screws for a light aircraft manufacturer, a 5/8-6 Acme thread must be cut to a length of 5 3/8" on cold-drawn stock, Spec. #A1S1, B1112. This thread must be held to the close tolerance of ±.001 between the P.D. of the thread and the O.D. of the screw, for the full thread length.

Former threading methods required two passes to produce the finished thread to the required tolerances—one roughing and one finishing cut. Even then, hand fitting with the mating nut was necessary during assembly.

These operations are now performed on a turret lathe equipped with a 1 1/4" LANDMATIC Head and a Lead Screw Attachment. The required thread is cut in one pass in .192 minutes using a spindle speed of 230 RPM. Recent correspondence shows that approximately 3,500 pieces are completed between regrinding of the chasers. The general manager states that "We are quite proud of the fact that this job has worked out as well as it has and it is still running very efficiently."

LANDMATIC Heads are stationary self-opening threading heads designed for use on turret lathes. Their unusually-large oversize capacity allows them to handle a wide variety of threading operations. For further information and specifications, write for illustrated Bulletins F-80 and F-90.

LANDIS Machine COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

MANUFACTURERS OF THREAD GENERATING EQUIPMENT

From here to finished

36 Type Gear Shaper Cuts Production Time

Fewer Machines... Greater Accuracy... Lower Costs... these are the results in a plant where two modern 36-Type Fellows Gear Shapers are doing the work of *five* ordinary machines in cutting the spur gears specified in the production chart at the right... producing more work of greater accuracy and cutting operating costs into the bargain.

The 36-Type can be adapted to a wide range of work... spur or helical gears, external or internal, herringbone gears as shown in the illustration, splines, and irregular shapes of all sizes up to and including 36" pitch diameter and 6" face width. All these can be generated on this Gear Shaper by the Fellows Method.

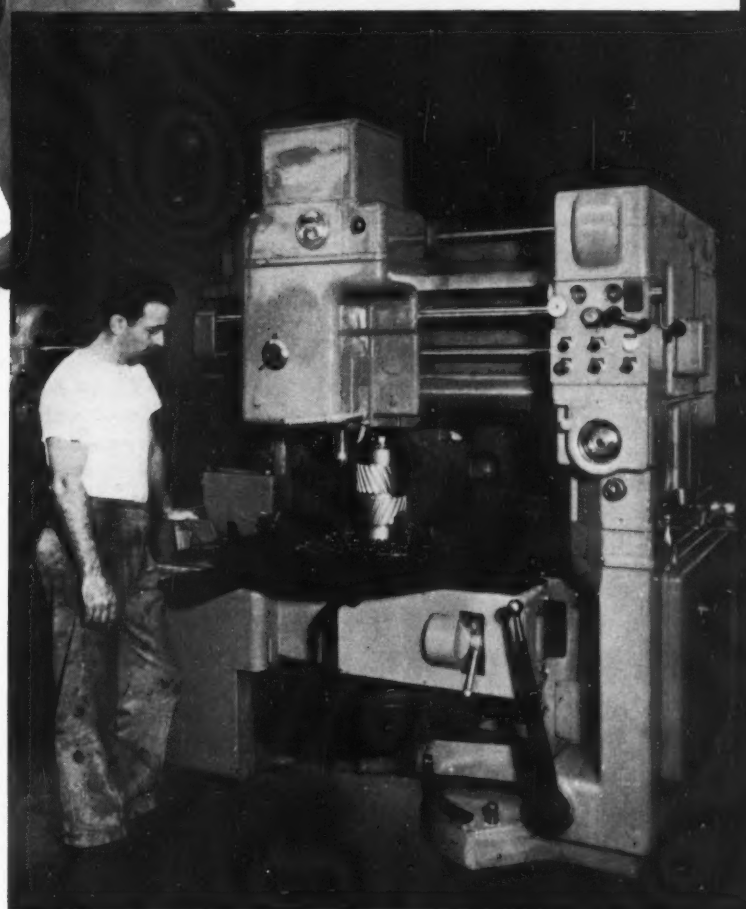
You can find out what the 36-Type Gear Shaper can do in your plant by talking with a Fellows Representative.

Fellows

The FELLOWS METHOD
...in action!

gear

By 65%



PRODUCTION PERFORMANCE

LARGE BRONZE SPUR GEAR (TOP)

Material . . . . . High tensile bronze #3
Face width . . . . 4 inches
Pitch diameter . . 34.000 inches (Special)
No. of teeth 138
Diametral pitch . 4
Production Time . 6 hours

Production Time with 36-Type Gear Shaper . . . 1 hr., 55 min.

STEEL SPUR GEAR

Material . . . . . Steel casting DW-19
Face width . . . . 3 inches
Pitch diameter . . 22.250 inches
No. of teeth 89
Diametral pitch . 4
Production Time . 10 hours

Production Time with 36-Type Gear Shaper . . . 2½ hours

GEAR SHAPER COMPANY

Head Office & Export Department: 78 River Street, Springfield, Vermont.
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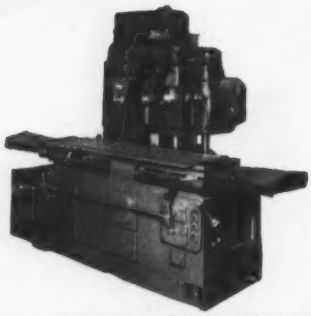
1



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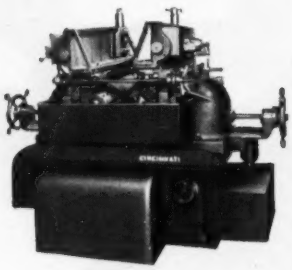

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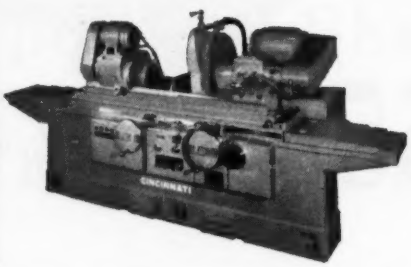

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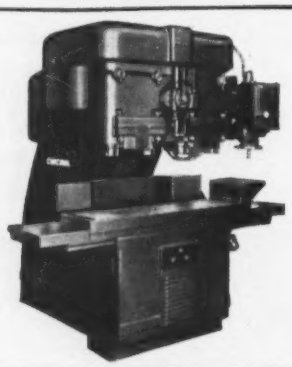

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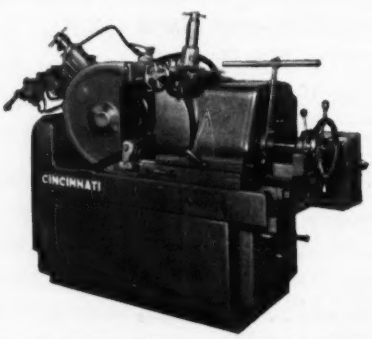

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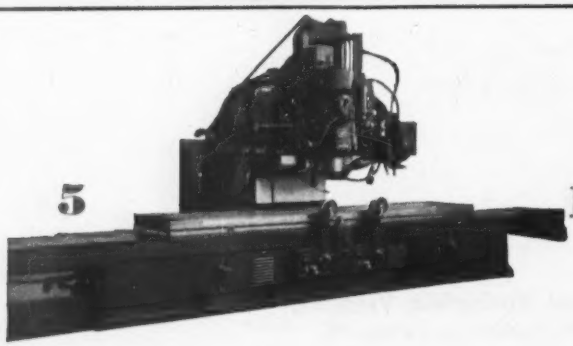

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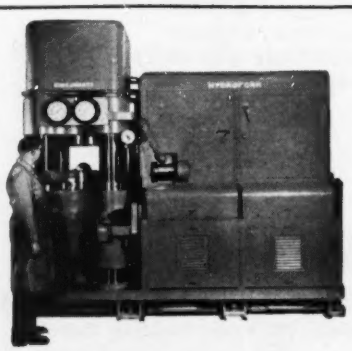
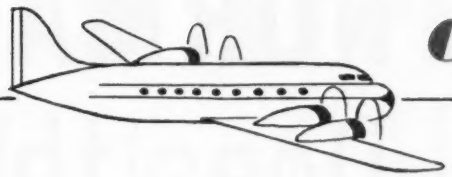


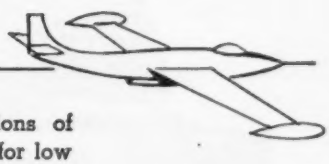
CINCINNATI



Cincinnati Machines

for low-cost production

of aircraft parts



Many specially designed machines and adaptations of standard equipment have been built by CINCINNATI for low cost production in aircraft engine and airframe plants. For your future requirements, CINCINNATI is prepared to continue to build this type of equipment. Of course, standard machine tools are still the backbone of aircraft production. Typical CINCINNATI machines for various phases of this type of work are illustrated here. All are briefly described in general catalog M-1776. You may obtain a copy at no obligation.

1 CINCINNATI Tracer Controlled Hydromatic Milling Machines. Catalog M-1602-1.

2 CINCINNATI No. 2-24 Automatic Milling Machines. Catalog M-1760.

3 CINCINNATI High Power and Dual Power Dial Type Millers. Catalogs M-1644-3 and M-1647.

4 CINCINNATI Four-Spindle 360-Degree Automatic Profile Milling Machine. Catalog M-1215-3.

5 CINCINNATI 28" Vertical Hydro-Tel Milling Machines. Catalog M-1773.

6 CINCINNATI No. 2 Cutter and Tool Grinder. Catalog M-1734.

7 CINCINNATI FILMATIC Centerless Lapping Machine.

8 CINCINNATI FILMATIC Plain Hydraulic Grinding Machines. Catalogs G-566-2 and G-603.

9 CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Catalog G-611-1.

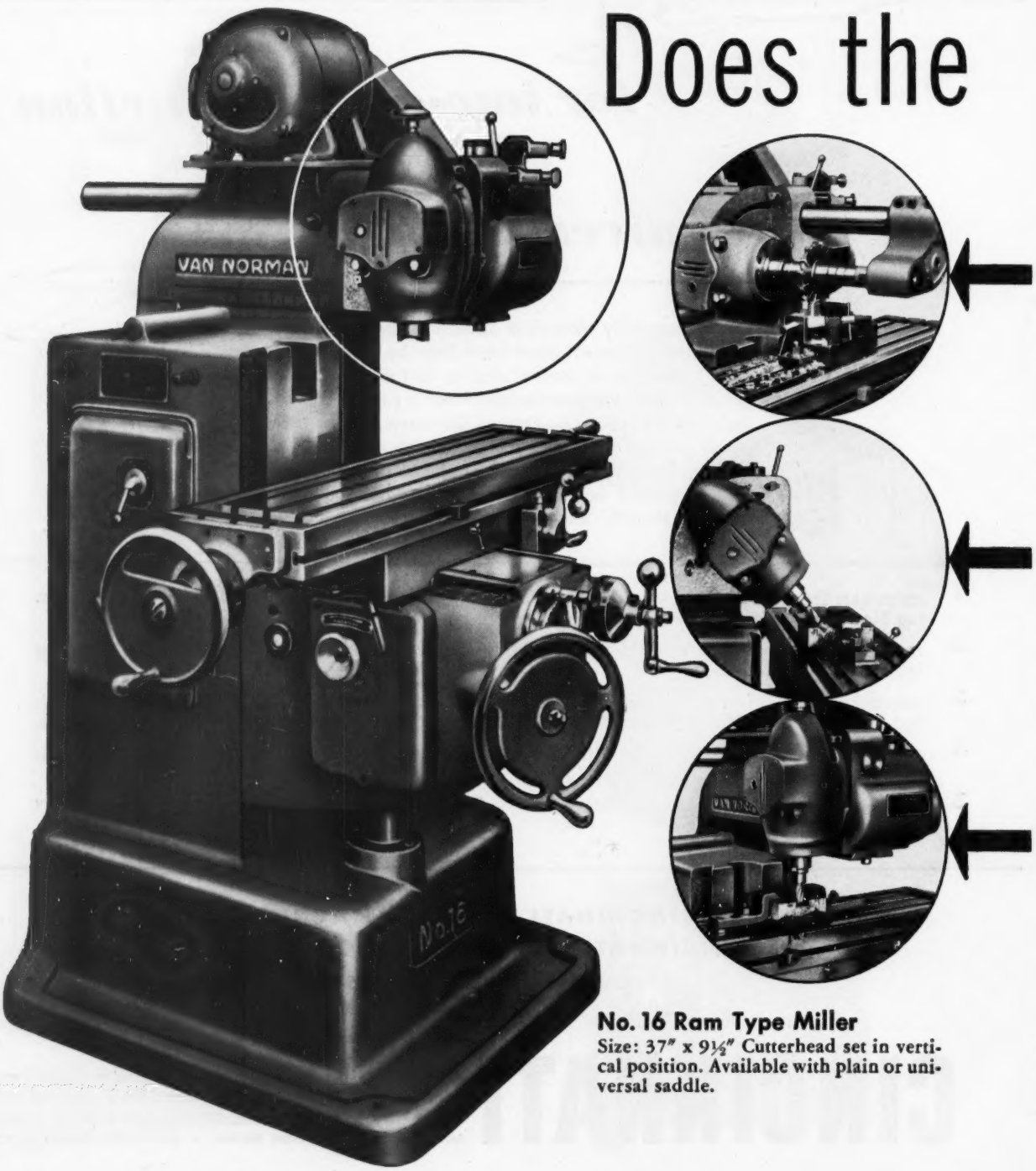
10 CINCINNATI Hydroform Machine, 12" to 32" sizes. Catalog M-1759-2.

THE CINCINNATI MILLING MACHINE CO
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Why Buy Three Single
SINGLE VAN NORMAN
Does the



No. 16 Ram Type Miller
Size: 37" x 9½" Cutterhead set in vertical position. Available with plain or universal saddle.

Purpose Millers when a **RAM TYPE MILLER** Work of All Three!

HORIZONTAL MILLING

Operator simply swivels the adjustable cutterhead to horizontal position . . . locks it in place . . . and he is ready for horizontal milling. Hardened stop set at factory assures positive 0° setting.

ANGULAR MILLING

With the cutterhead locked in the desired angular setting, the operator performs angular milling operations. Cutterhead is graduated in degrees from 0° to 90° for easy positioning.

VERTICAL MILLING

Conventional vertical milling is easily performed by locking the head in vertical position. Permanently fixed hardened stop permits accurate setting of cutterhead at 90°.

Conventional horizontal and vertical, as well as angular milling all on ONE miller . . . that's what you get with Van Norman Ram Type Milling Machines. The adjustable cutterhead, mounted on a movable ram, enables you to perform all types of milling by simply positioning the cutterhead in the desired position. Not only does this important feature give you the workability of *several single machines,* but it also minimizes work set-ups . . . cuts idle machine and operator time by permitting you to meet job to job milling requirements as they occur.

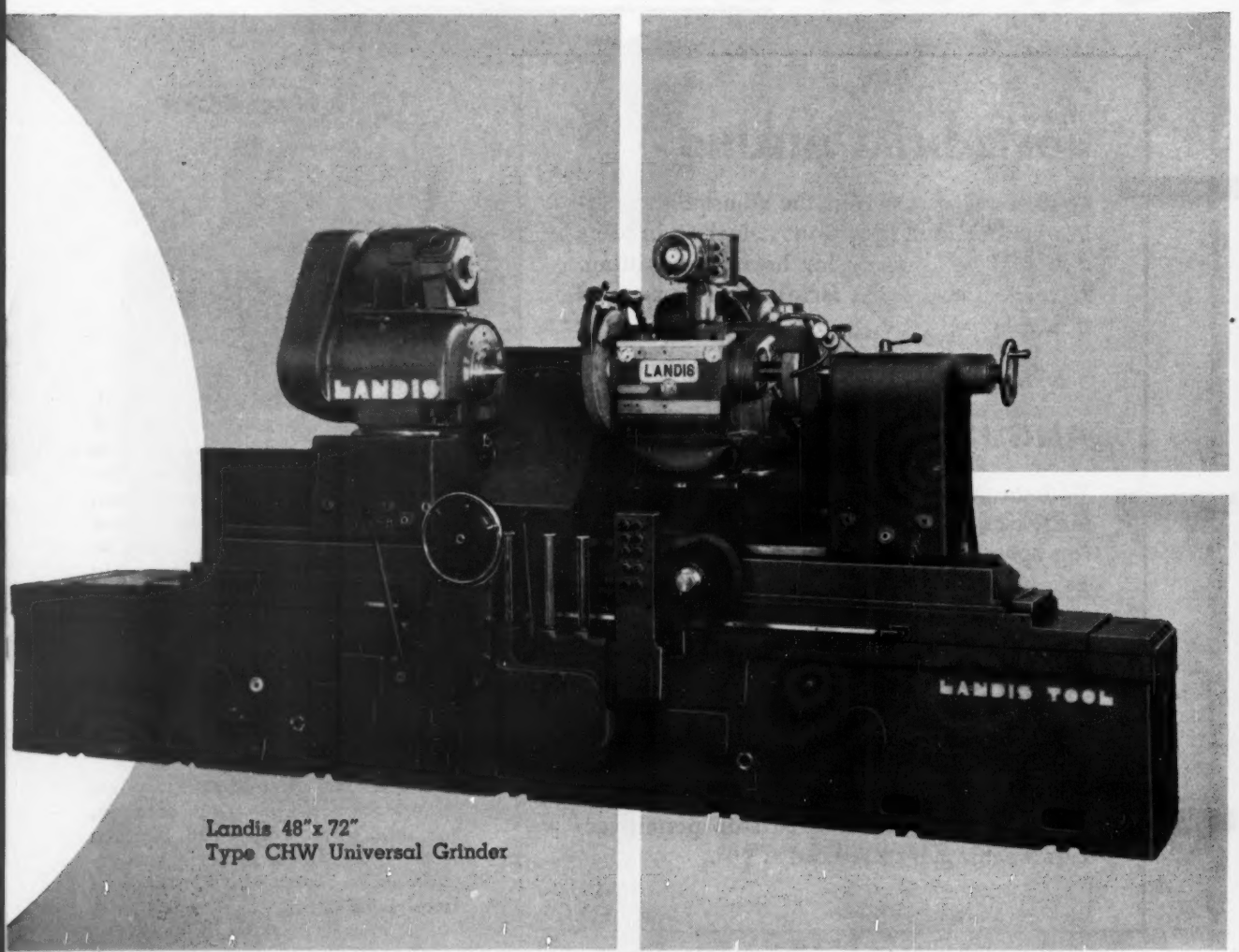
Whether it is for toolroom, production, machine shop, tool and die shop, or laboratory work, Van Norman Ram Type Millers increase production and cut costs. A wide range of models in various sizes are available to fit most every application. Write for information.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

New Landis Development for

Maintenance problems solved with new type CHW Universal Grinders



Landis 48"x 72"
Type CHW Universal Grinder

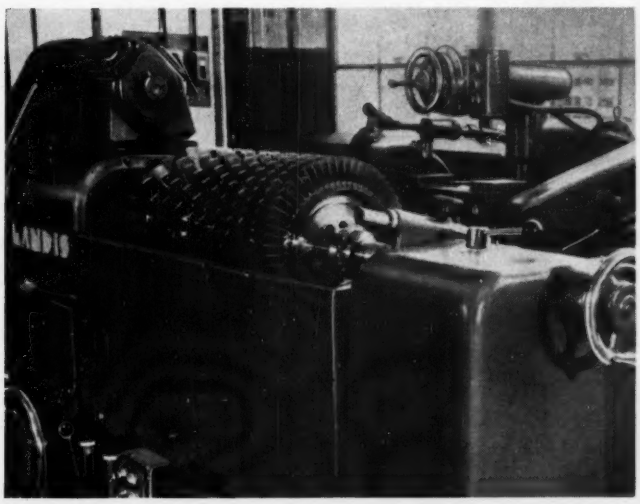
LANDIS
precision grinders

Work swings up to 48" diameter. Length between centers up to 120". If you have a problem grinding large diameter, send us your blueprints for tooling and production estimates.

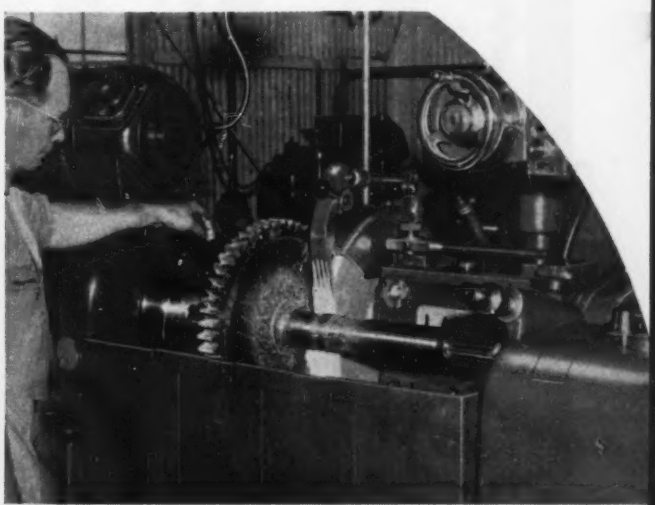
143

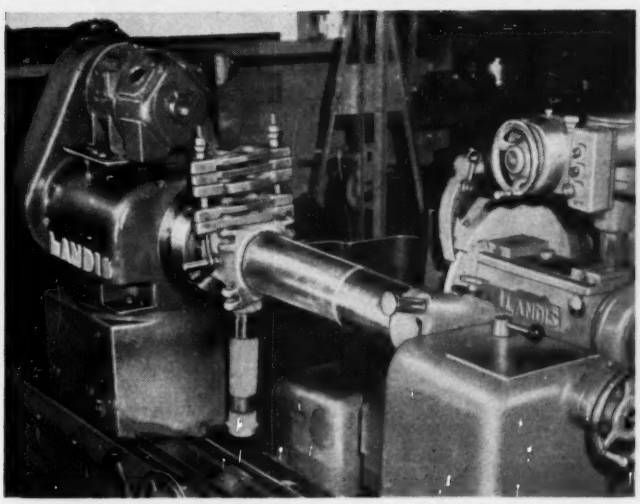
Precision Grinding of Aircraft Parts

COMPRESSOR ROTOR ASSEMBLY
Grinding tips of replacement blades on compressor rotor assembly. Stock removal .075" on diameter. Work held between centers. Extra wide carriage ways provide stability for heavy stock removal and precision limits.

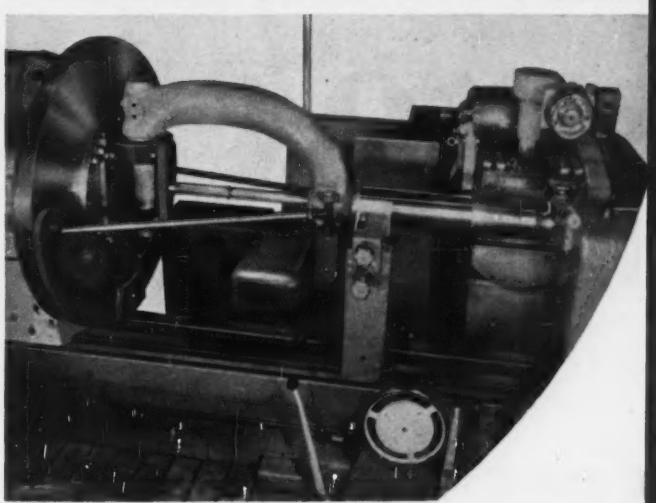


TURBINE WHEEL AND SHAFT
Maintenance grinding of turbine shaft. Stock removal .012" on diameter, grinding chrome carbon steel. Limits are .0005" on diameter. Operator has excellent view of work and wheel.





LANDING GEAR INNER CYLINDER
Counter balanced because the weight distribution is unusual. Stock removal is .006" on diameter from chrome plate. Work chucked and driven from live spindle headstock.



LANDING GEAR FORK AND AXLE ASSEMBLY
Recondition grinding operation with special fixture holding and centering work against face plate. Stock removal is .016" on diameter from chrome plate.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

U.S. SLIDE FEEDS REDUCE COSTS

—even on low Production Runs!

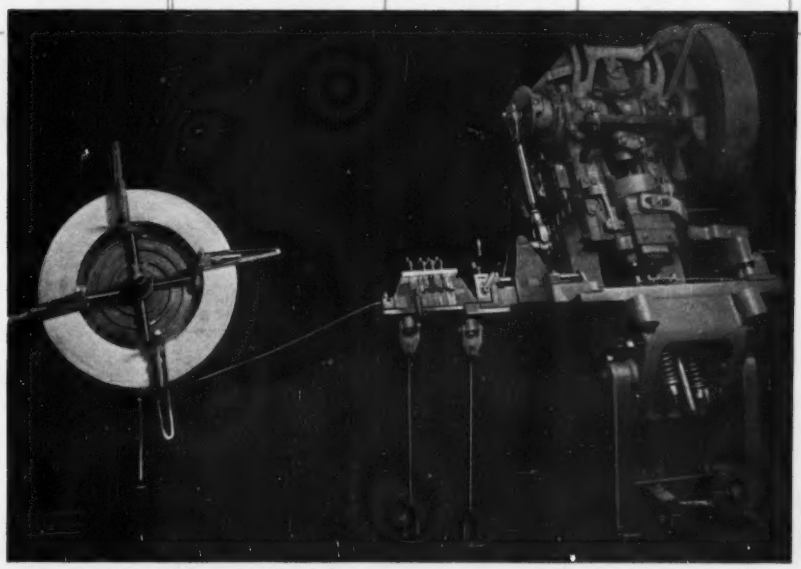
U.S. TOOL

THE belief sometimes exists that long production runs are necessary for the economical use of automatic feeding equipment on punch presses. A New Jersey manufacturer of electrical devices has disproved this theory by the advantageous use of U.S. Slide Feeds where the required production is as low as 1000 pieces.

At this plant the same press and feed are used for producing a variety of parts. In changing from one part to another, they simply install the proper dies in the press, and reset the feed to provide the proper pitch or feed length. Experiments have been made to determine the production quantity where automatic feeding becomes profitable. They have found this to be a production run of 1000 pieces. Their findings on a typical job are illustrated in the table below.

It will be noted that for any run in excess of 1000 pieces, substantial gains are made by using U.S. Slide Feeds. It should be pointed out that the jobs in question involve the use of progressive dies necessitating the maintenance of controlled accuracy of pitch. U. S. Slide feeds provide the required accuracy without the use of pilots or stops. In addition, the Slide Feed pulls the material through a U.S. Plain Straightener and maintains controlled accuracy.

METHOD OF FEEDING	TIME TO SETUP DIE	TIME TO SET FEED	TIME TO RUN 1000 PIECES	TOTAL TIME	TIME-SAVING EACH ADDT'L 1000 PIECES
HAND FEED	SAME FOR HAND OR AUTOMATIC FEEDING	NONE	30 MINUTES	30 MINUTES	
AUTOMATIC WITH U. S. SLIDE FEED	SAME FOR HAND OR AUTOMATIC FEEDING	20 MINUTES	10 MINUTES	30 MINUTES	20 MINUTES



The photograph shows a setup consisting of a U.S. Slide Feed and a U.S. Plain Straightener on a standard open-back inclinable press.

Bulletin No. 80-M gives complete specifications for U.S. Slide Feeds and other units, such as Straighteners, Stock Reels, Coil Cradles, Scrap Choppers, Oilers and Wipers. Write for your copy—there's no obligation.

COMPANY, Inc. AMPERE (East Orange) NEW JERSEY

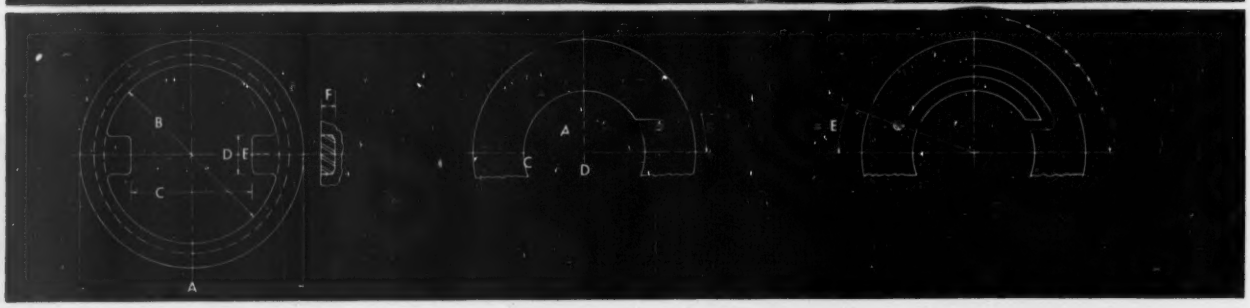
Builders of U. S. Multi-Slides–U. S. Multi-Millers

U. S. Automatic Press Room Equipment–U. S. Die Sets and Accessories

PRODUCTION TIME

PRODUCTION DATA

PART — QUICK CHANGE CLAMP COLLAR
MATERIAL — SAE 4615.
CUTTER — ¼ dia. — 2 lip — HSS endmill.
SPINDLE SPEED — 600 rpm — (80 sur. ft./min.)
LOT SIZE — 25 to 50 pcs.
CYCLE TIME (FLOOR TO FLOOR) — 15¾ minutes.
PREVIOUS CYCLE TIME — 34 minutes.



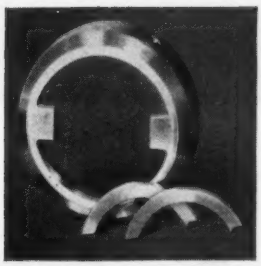
(A) 6" (B) 4⅝" (C) 3¼"
(D) −1" + ±.000 (E) −1" + ±.005 (F) ⅜"

OPERATION 1 — Rough mill one side of tongue.
PROCEDURE — Offset spindle slide radius (A), set rotary head to angle (B), feed table to workpiece centerline (C to D).

OPERATION 2 — Rough mill radius section between tongue.
PROCEDURE — Rotate head from angle (B) to angle (E).

REDUCED BY 53%!

Rotary Head Milling Machine simplifies method and cuts costs on still another production job



Here's the completed workpiece together with two pieces of waste.

IN production of this Quick Change Clamp Collar, considerable savings were effected by using a versatile Kearney & Trecker No. 2 Model D Rotary Head milling machine.

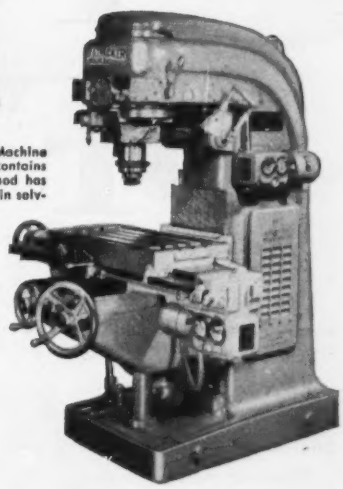
The radius of the piece was produced merely by offsetting the spindle slide and rotating the machine's head. The job was done faster, more accurately than would be possible with any other method.

Practically no other standard machine can mill these parts without a change in setup and cutters, maintain accuracy, yet complete the job in less than 16 minutes!

For details of this operation, see the diagrams below. Note: Model D's table and saddle movements are independent, will not affect the radius setting—think what that means not only to this job, but also in terms of a wider range of applications for other work.

Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests for booklet to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS ®

OPERATION 3 — Rough mill one side of opposite tongue.
PROCEDURE—Feed Machine table from (D) to (F).

OPERATION 4 — Rough mill end of tongue.
PROCEDURE—Feed machine saddle from (F) to (G).

OPERATION 5 — Rough mill second half of inner contour.
PROCEDURE — Repeat Operations 1 through 4, working area to be in the lower half of opening.

OPERATION 6 — Finish mill 4⅛" dia., end of tongues to 3¼" dimension and width of tongues to 1" + .000 —.005.
PROCEDURE — Reverse sequence of Operations 1 through 5.

Vertical lapping machine type 16FC has outstanding production capacity in such work as diesel injector parts, plug gages, size blocks, the sides of rings, and rollers. It produces flat or cylindrical work to a high degree of dimensional accuracy, parallelism and finish. Work capacity: 3″ x 5″ flat and 3″ diameter cylindrical.

LAPPING MACHINES THAT GIVE YOU THE

"TOUCH OF GOLD"

Here they are. Six great lapping machines by Norton. Each designed for single or multi-purpose — but all built to give you the "Touch of Gold."

Every second of operation, value is being added to the product through a finer, smoother, precise finish achieved in less time. This adds to your profit margin and to the ultimate user's satisfaction.

Whatever your needs there is the right Norton Lapping Machine to give you maximum output, minimum downtime; higher quality work and less dependence on manual skills.

Send for more complete information or submit samples of your work for correct lapping machine application and production. NORTON COMPANY, Worcester 6, Mass.

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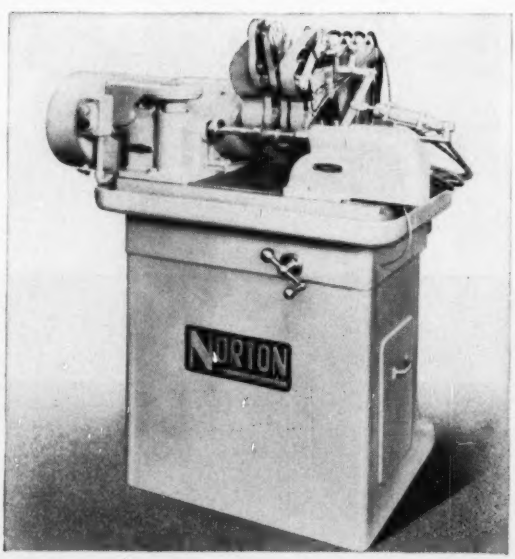
NORTON

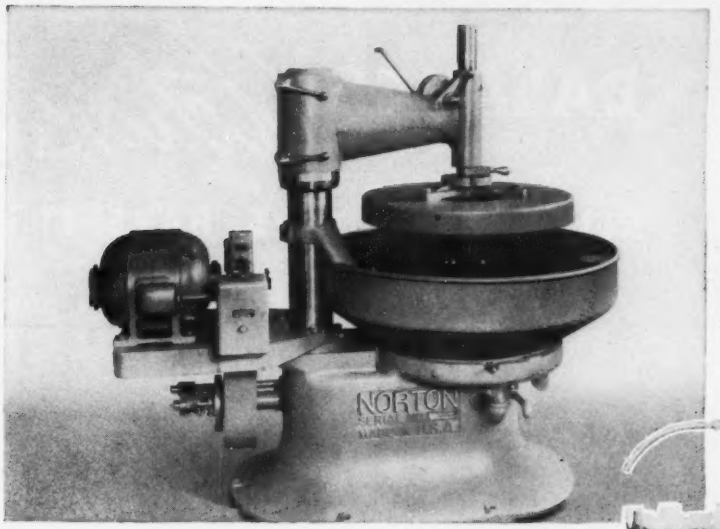
GRINDERS *and* LAPPERS

Making better products . . . to make other products better

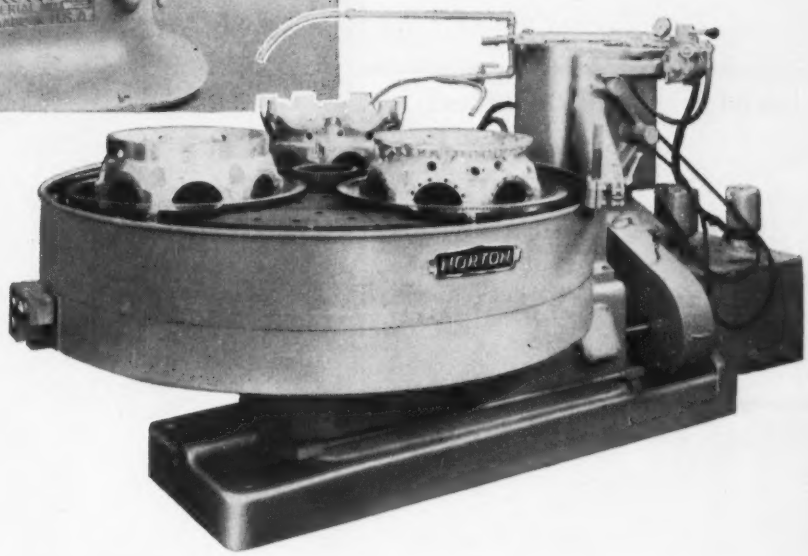
District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5



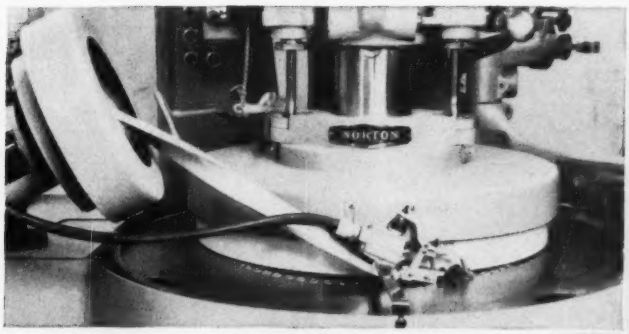
Simplex surface finisher No. 12. A highly efficient machine which uses flexible coated abrasives. Ideal for handling small crankshafts for refrigerator compressors and outboard motors, eccentric and concentric cylindrical surfaces, journals and seal surfaces on many cylindrical parts. Work capacity: ½″ to 2½″ diameter; up to 12″ length.



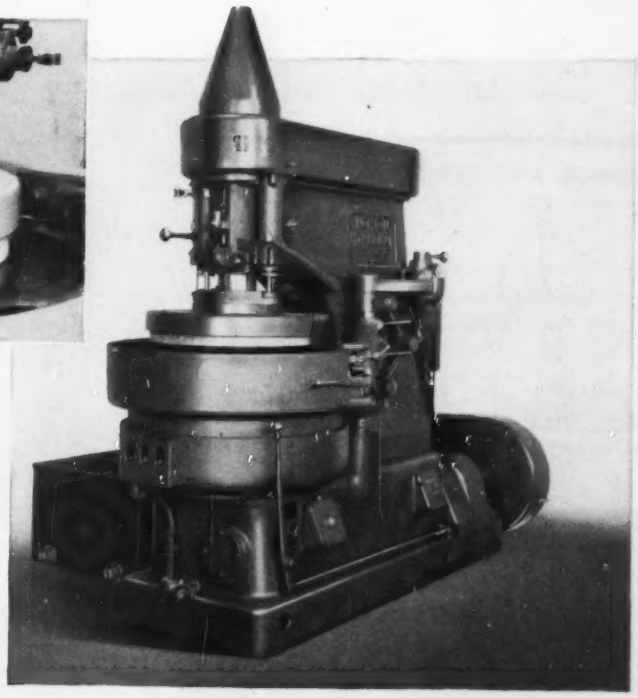
Vertical lapping machine No. 2. Arranged for flat or cylindrical surfaces requiring extremely close tolerances and degree of finish. Uses cast iron laps in conjunction with loose abrasive and a suitable lubricant or vehicle. An attachment for cylindrical lapping is furnished with the regular flat lapping machine; also a special arrangement for single face lapping is available. Work capacity: flat 4" x 9" and 4" diameter cylindrical.



60" single face flat lapping machine. Bonded abrasive laps make it a sensational performer, particularly on soft metals. It produces a clean finished surface free from imbedded grit. Provides seal surfaces, wear surfaces or flat surfaces for other machining operations. Hydraulic pressure device is available for light work; power-operated truing arm, loadless-starting inertia-delay clutch. Capacity range, three 24" pieces — one 60" piece.



Through-feed No. 26 Hyprolap machine. 4-to-1 savings proved on finishing small, flat parts. Handles small pieces up to 8,000 an hour. Loading and unloading are entirely automatic . . . less downtime for lap dressing because work path traverses the entire work surface of each lap. High worker skills are not needed. Work up to 1¼" diameter. Modifications to handle larger work.

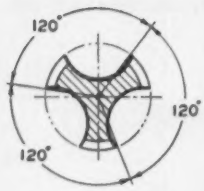


Hyprolap lapper No. 26. Extremely fast-cutting machine using bonded abrasive laps and filtered coolant. Finishes 20 or more work pieces simultaneously with a combination of accuracy and finish-uniformity otherwise unobtainable in mass production. Easy to operate. Lapping pressure is hydraulic powered and controlled — an exclusive Norton feature. Work capacity up to 3" thickness or diameter, to 7½" length.

BALANCED Action

ALL WINTER TAPS HAVE IT

EXACT FLUTE SPACING



is the first fundamental of Balanced Action. It is accomplished by precision indexing.

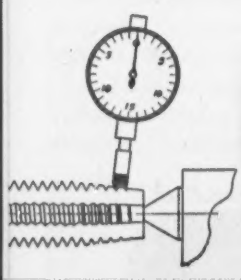
UNIFORMITY OF FLUTE CONTOURS

is essential, of course. You can't get Balanced Action without it.

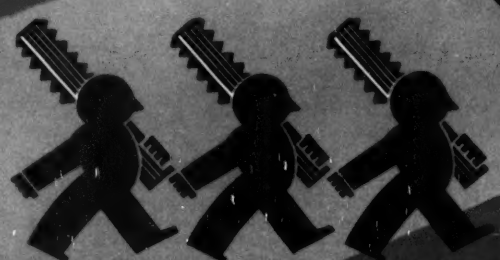
PRECISION CHIP DRIVER CONTOURS

are exact to size, shape, and position —formed to give optimum performance.

ACCURATE AND CONCENTRIC CHAMFERS



By holding shank, chamfer, and thread concentricity to very close limits, hole-accuracy is assured.



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NATIONAL METAL SLITTING SAWS—the choice of experienced tool users—are available in a wide range of stock sizes and widths. Many special types—also slotting cutters.
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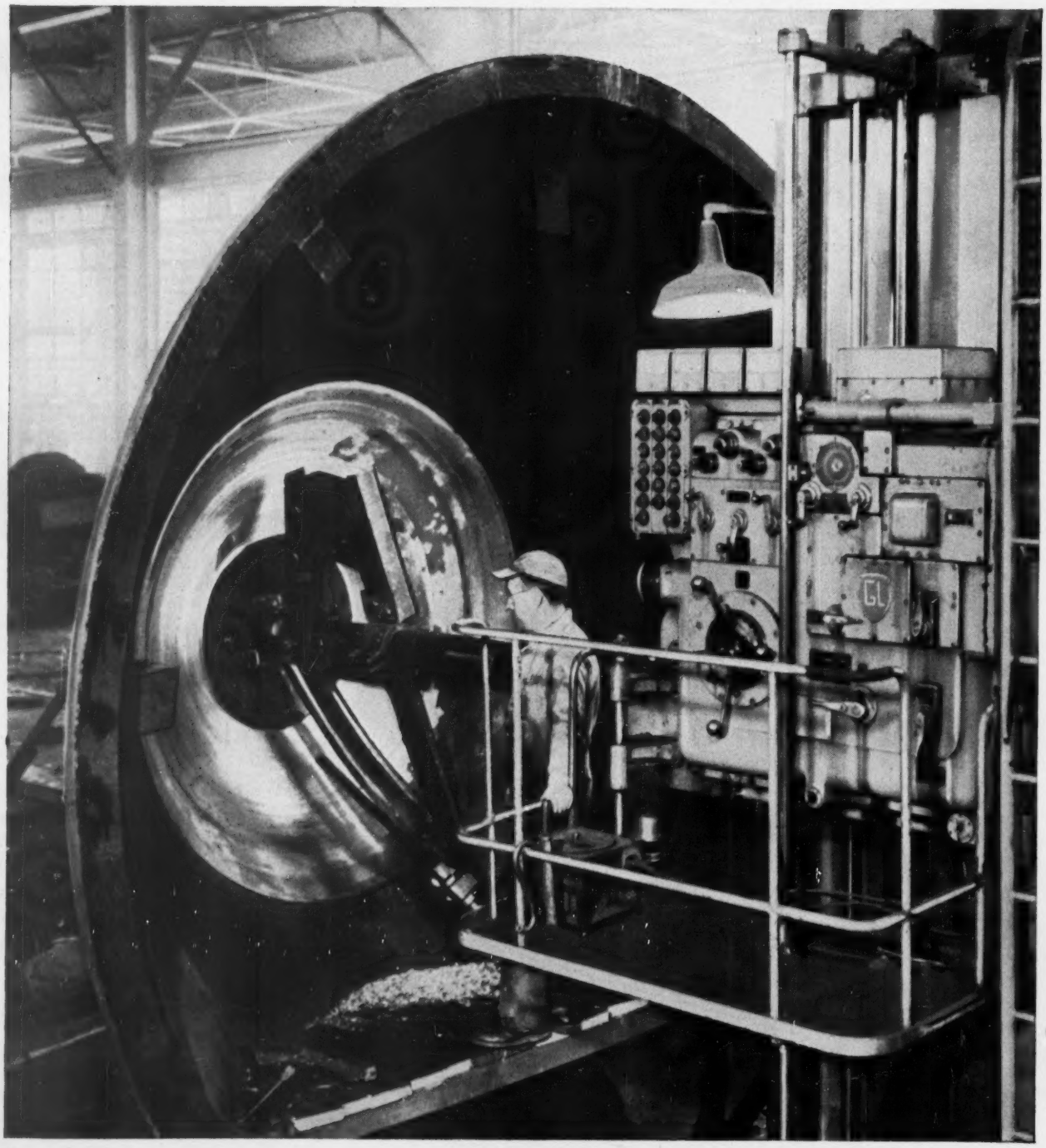
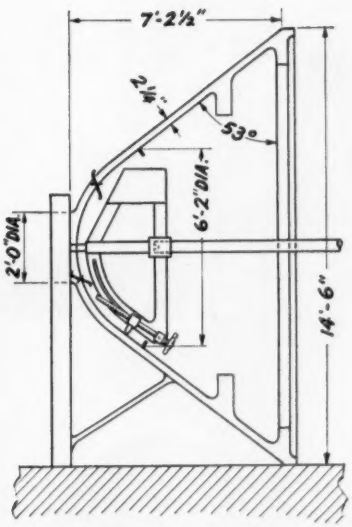
. . . For all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs, and Special Tools.

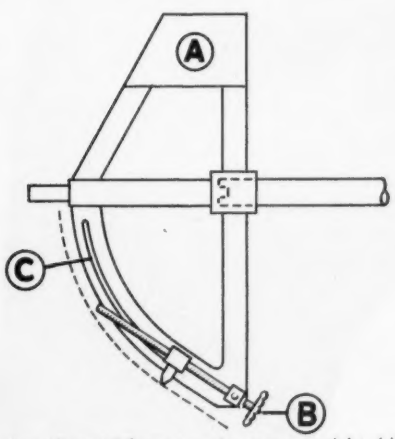
How would you finish in a 14½′ x 14½′ x 7¼′



a spherical radius cast steel workpiece?



Casting is set up on edge, and 8" I-beam tripod welded to support it. Jacks are used at outer rim for bracing . . . stops are set in floor plate to provide additional rigidity. Special fixture on machine spindle revolves inside casting.



Size of special fixture requires counterweight, (A). As machine spindle revolves fixture, star feed cutter (B), and holder in travel in machine slot in fixture (C) . . . controlled path generates the spherical radius. As operation proceeds toward center of bell, it is necessary to change the length of the actuating screw to avoid interference with the casting.

This unusual job on a 38,000-lb. blast furnace bell is simplified by use of a G&L 560-F floor type Horizontal Boring Mill

A versatile G&L machine, relatively inexpensive tooling and ingenuity . . . here's how they provided an answer to an unusual problem.

William B. Pollock Company of Youngstown, Ohio, took full advantage of the G&L floor type's open construction and excellent versatility.

First of all, they designed a somewhat unusual setup. The circular rough finished casting is set on edge facing the machine's main spindle. Eight-inch I-beams welded to the casting's top and extending to the floor act as braces. Jacks and stops are also used to keep the bell rigid.

After a 2¾" pilot hole is drilled and bored through the center of the top of the bell, a hardened bushing is inserted. This bushing serves as a pilot for the extension of the special fixture. The latter (see illus. lower right), is essentially a star feed tool with the tool holder traveling in a machined slot in the fixture. Its movement controls the path of the tool and generates the spherical radius. Stock removal varies from ¼" to 1½", depending on the concentricity of the rough casting.

In the photo, you will note the large unfinished portion in the center of the casting. It will be finished after the larger diameter has been finished to depth. This is done to remove surface imperfections such as the one appearing above the operator's head in the photo. To complete the job it's necessary to use a longer actuating screw to push the tool around to that part of the cam track.

If you, like William B. Pollock Co., face unusual production problems, call in your G&L representative. He'll be pleased to help you solve them . . . tell you how you can take advantage of the 5-point G&L analysis service. BUT DON'T DELAY . . . DELIVERY ON G&L MACHINES MAY BE BETTER THAN YOU THINK.

GIDDINGS & LEWIS MACHINE TOOL CO.
Fond Du Lac, Wisconsin, U. S. A.

Builders of the world's finest Horizontal Boring, Drilling and Milling Machines — table, floor and planer types: Hypro Planers, Planer Type Milling Machines and Vertical Boring Mills: and G&L machine tool accessories.

"If MORSE CUTTERS are good enough to make Morse Tools . . . then they're plenty good for us, too!"

That's right — Morse Milling Cutters are used every day in the Morse plant — to make all Morse Cutting Tools the finest precision made tools in the market.

Morse knows from years of closely checked experience, that these Cutters impart longer life, smoother cutting action, and higher return per sharpening than any other cutters. And when you "thrive on your own cooking," then that's proof that the cooking is tops!

Besides the cutters shown here, your Morse-Franchised Distributor can supply you with Angle, Concave or Convex Cutters, Woodruff Keyseat and Involute Gear Cutters, and others. He's your right-hand man for cutting costs — so see him today about the Morse Milling Cutters you need in *your* operation.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
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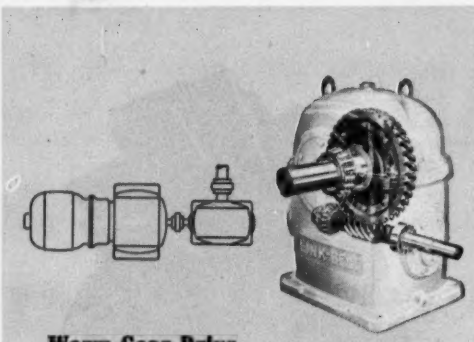
MORSE

Cutting Tools

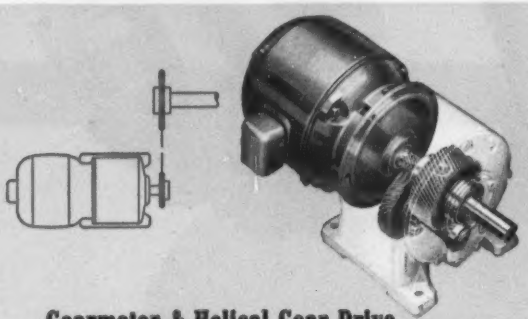
Buy them by phone from your Morse-Franchised Distributor and save ordering time

LINK-BELT makes even your most complex speed reduction jobs *simple*



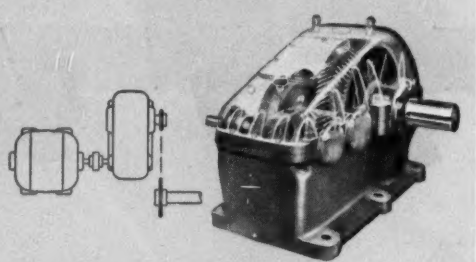
Worm Gear Drive

WORM GEAR and P.I.V. variable speed drives are shown direct-coupled. Link-Belt worm gear drives are available in 3.1:1 to 8000:1 reduction ratios — 1400 to 123,000 in. lbs. torque — 0.22 to 564 output shaft rpm. Ask for Book 2324A.



Gearmotor & Helical Gear Drive

GEARMOTOR is shown with roller chain drive. Link-Belt Helical Gear Drives, Gearmotors and Motogears are available in 6.2:1 to 292:1 reduction ratios — 1 to 30 hp — 6 to 280 output shaft rpm. Ask for Books 2247 and 2451.



Herringbone Gear Drive

HERRINGBONE GEAR DRIVE is shown connected by flexible coupling to motor and with roller chain takeoff. Link-Belt Herringbone Gear Drives are available in 2.84:1 to 326:1 ratios — 0.4 to 2480 hp — 2.2 to 623 output shaft rpm. Ask for Book 2519.

Get the proper drive combination that best meets your overall requirements from a broad line

ONLY Link-Belt can offer you such a broad selection of helical, herringbone and worm gear drives . . . plus the pre-engineered correlation of all its other power transmission equipment. This exclusive combination not only simplifies even the most complex problem — it actually cuts your costs. Here's how:

(1) You save on installation. Dimensions of all components — chains, sprockets, couplings, bearings — are correlated with the reducer's. There's no alignment problem . . . no need to exchange drawings with other suppliers.

(2) You save on operating costs. Power consumption is lower because overall efficiency is assured. And maintenance costs go down when you rely on quality-built Link-Belt equipment.

Let a Link-Belt representative help you figure the best combination for your speed reduction requirements. You'll find it pays to make the nearby Link-Belt sales office or distributor your power transmission headquarters.

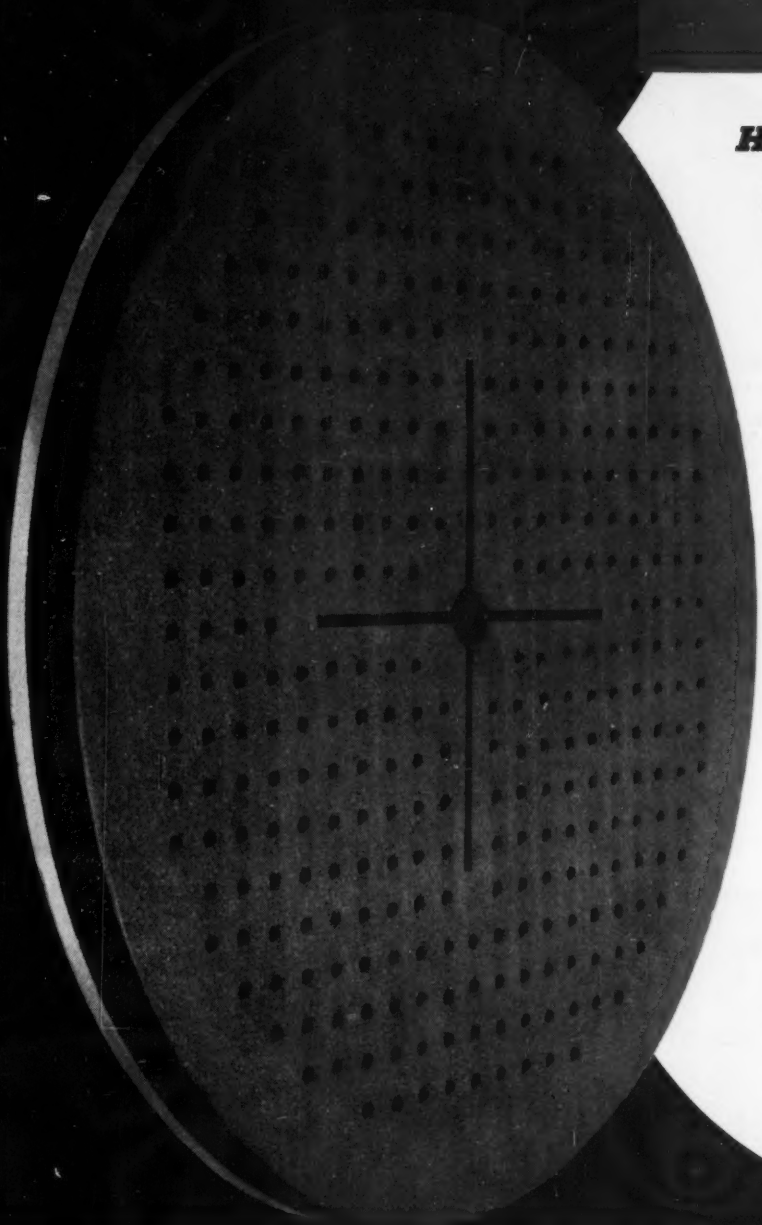
LINK-BELT

ENCLOSED GEAR DRIVES

13,128

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

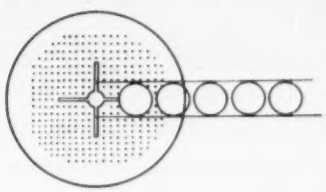
Gardner Abrasive Engineering



How a new type disc improved coolant distribution . . . made feed-thru grinding more efficient

THE PROBLEM

When grinding parts approximately 4" diameter on a double spindle grinder with feed-thru fixture, inaccurate work and some burning was experienced. Coolant introduced through hollow spindles did not properly reach grinding area.



THE SOLUTION

Four 1/4" wide radial slots extending out from center hole were introduced into abrasive to insure a free, uniform flow of coolant to work. Result: Stock removed without burning; required tolerances and production maintained.

Gardner Abrasive Engineering offers experience derived from making both the grinding machines and the abrasive discs. It considers machine performance first and then evaluates how grade and grain of abrasive affect grinding results. If standard abrasive discs won't do the job, discs are made *just for you.*

For help with your grinding problem, consult the Gardner Abrasive Engineer. IIIA

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

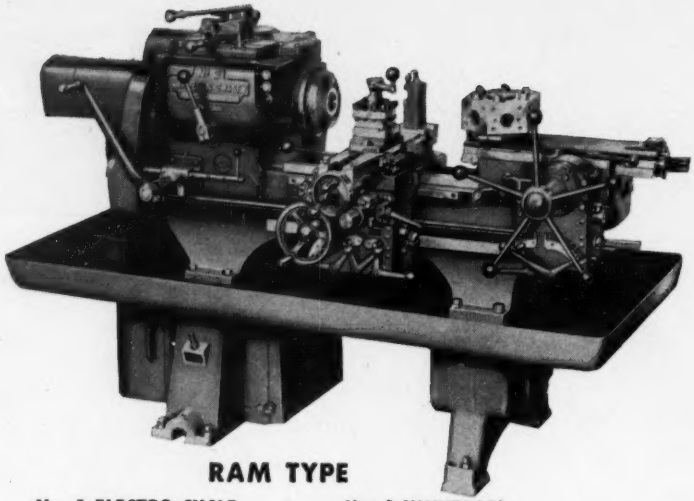
GARDNER

abrasive discs

TURRET LATHES

Warner & Swasey Turret Lathes are built in sizes and capacities to handle a wide range of jobs. Each machine is specifically designed for its rated bar or chucking capacity.

They are recognized everywhere for their ruggedness and extreme precision, and known for their high productivity, low upkeep, ease of operation, and dependability in holding built-in accuracy over a long period.



RAM TYPE

No. 1 ELECTRO-CYCLE
Bar Capacity ⅝" — Swing 11"

No. 2 ALL-GEARED HEAD
Bar Capacity 1" — Swing 14"

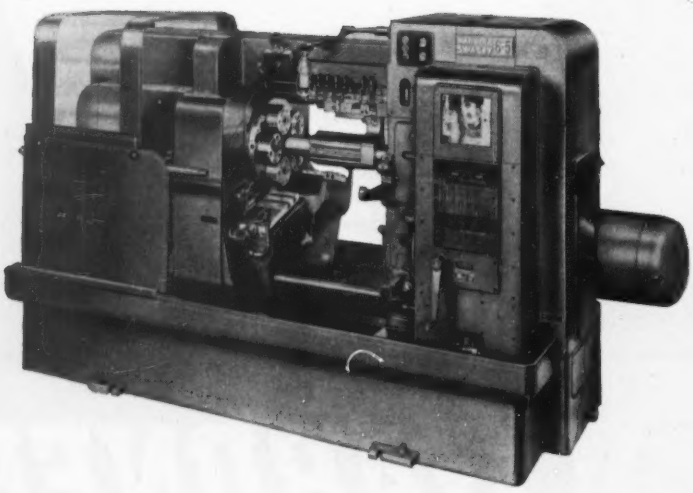
No. 3 UNIVERSAL
Bar Capacity 1½" — Swing 15⅜"

No. 4 UNIVERSAL
Bar Capacity 2" — Swing 18⅛"

No. 5 UNIVERSAL
Bar Capacity 2½" — Swing 20"

LOOK TO WARNER & SWASEY

FOR YOUR

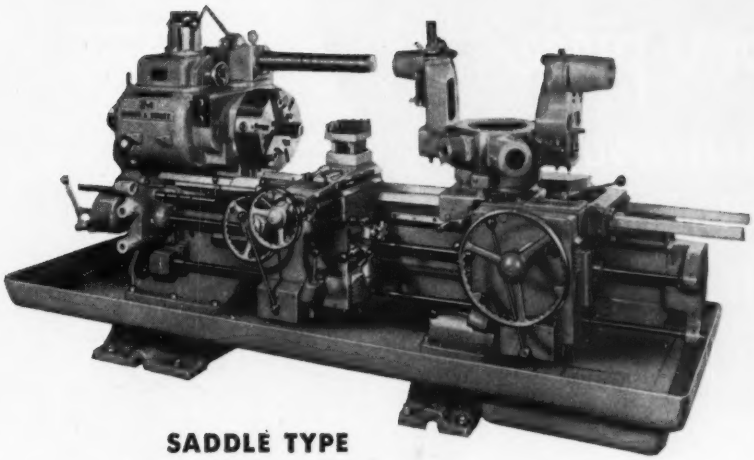


5-SPINDLE AUTOMATIC MACHINES

M-2500 Bar Capacity 1¾"
M-2530 Bar Capacity 2¼"
M-2540 Chuck Swing 6"
Turning Stroke 0-5"

Small and medium lots as well as long runs are now practical on an automatic basis because of the quick setup of these Warner & Swasey 5-Spindle Automatics. Patented "Quick-Set" Quadrants for adjusting feed strokes and cross slide strokes make setup easy and fast, eliminate all cam change worries. Now you can increase your production in less floor space—mass produce uniform, high precision parts at lower cost with these Warner & Swasey Automatics.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY



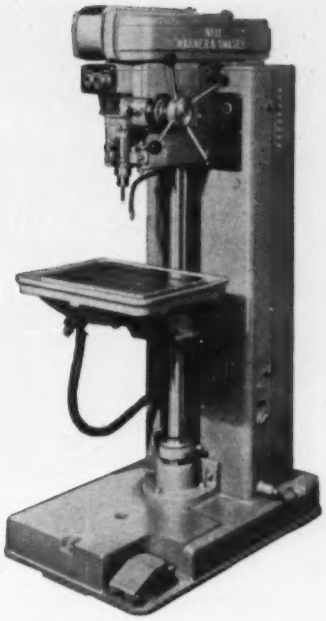
SADDLE TYPE

1-A UNIVERSAL HEAVY DUTY
Bar Capacity 2½" or 3"—Swing 16¼"

2-A UNIVERSAL HEAVY DUTY
Bar Capacity 3½"—Swing 20"

3-A UNIVERSAL HEAVY DUTY
Bar Capacity 4½" or 6"—Swing 23½"

4-A UNIVERSAL HEAVY DUTY
Bar Capacity 8", 9" or 12"—Swing 28¼"



PRECISION TAPPING AND THREADING MACHINES

No. 10 0-80 to 10-24 Capacity
No. 11, No. 11-R 8-36 to ⅞" Capacity
No. 12 ⅜" to 2½" Capacity

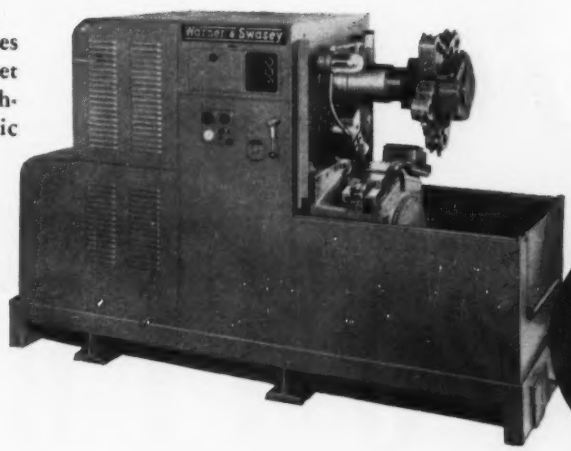
Positive tap lead—solenoid actuated guide fingers operating on a lead screw—produces threads as accurate as the tap itself. Eliminates drag or backlash. Depth can be controlled within one-tenth revolution of the tap. Also cuts left hand and external threads. Speed changes easily made. Setup quick and easy.

TURNING NEEDS

SINGLE SPINDLE AUTOMATIC CHUCKING MACHINE

**8½" Swing over cross slide—
6" working stroke**

Sets up fast—like a turret lathe. Uses turret lathe tools and machines turret lathe lots on an automatic basis, without the usual penalties of automatic operation. And the 1-AC will combine certain operations not possible in accepted turret lathe practice, reducing machine time. Automatically changes feeds and speeds under cut for more efficient use of cutting tools. Requires less skill to operate, and in many cases one man can handle two or more machines.



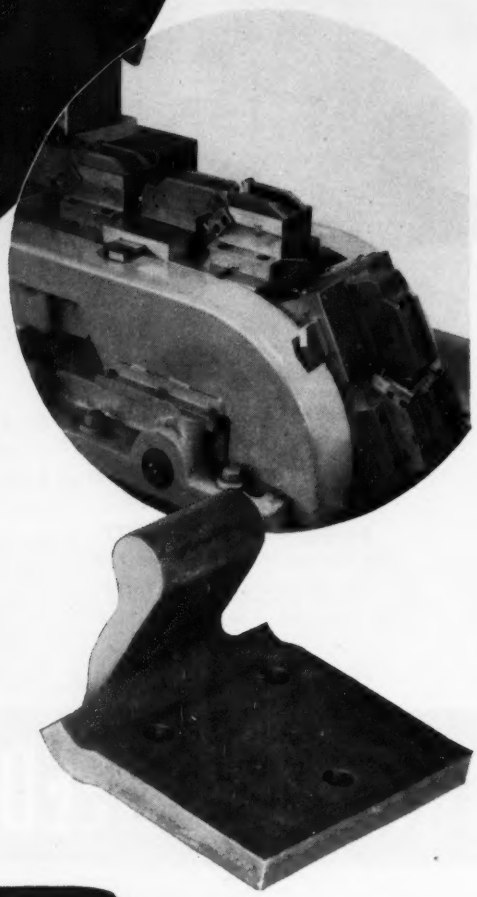
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

lower cost per piece . . .

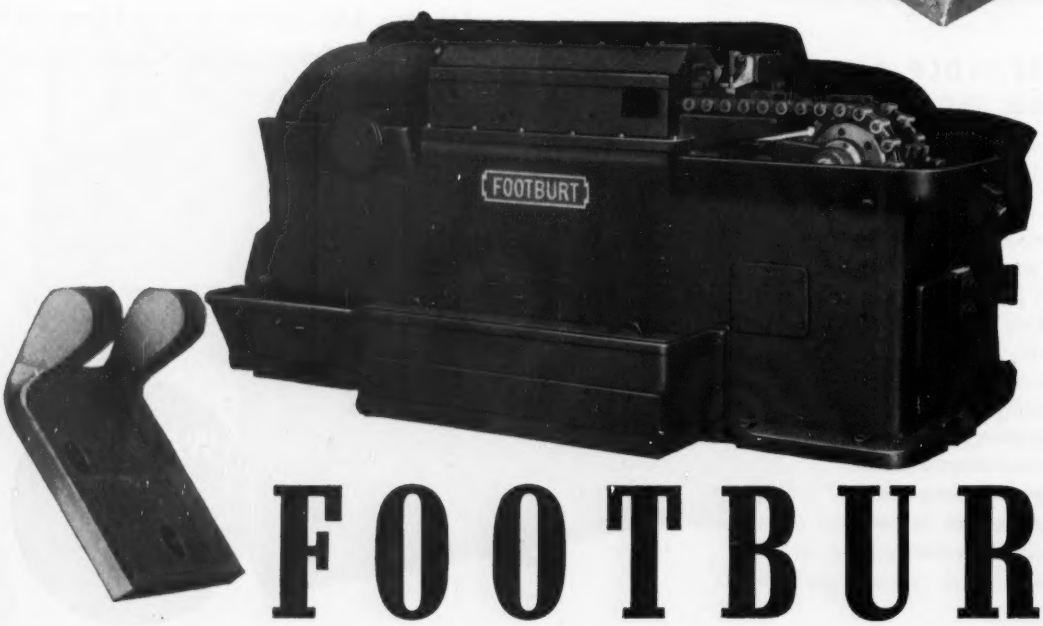
with continuous surface broaching of small parts

• Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.



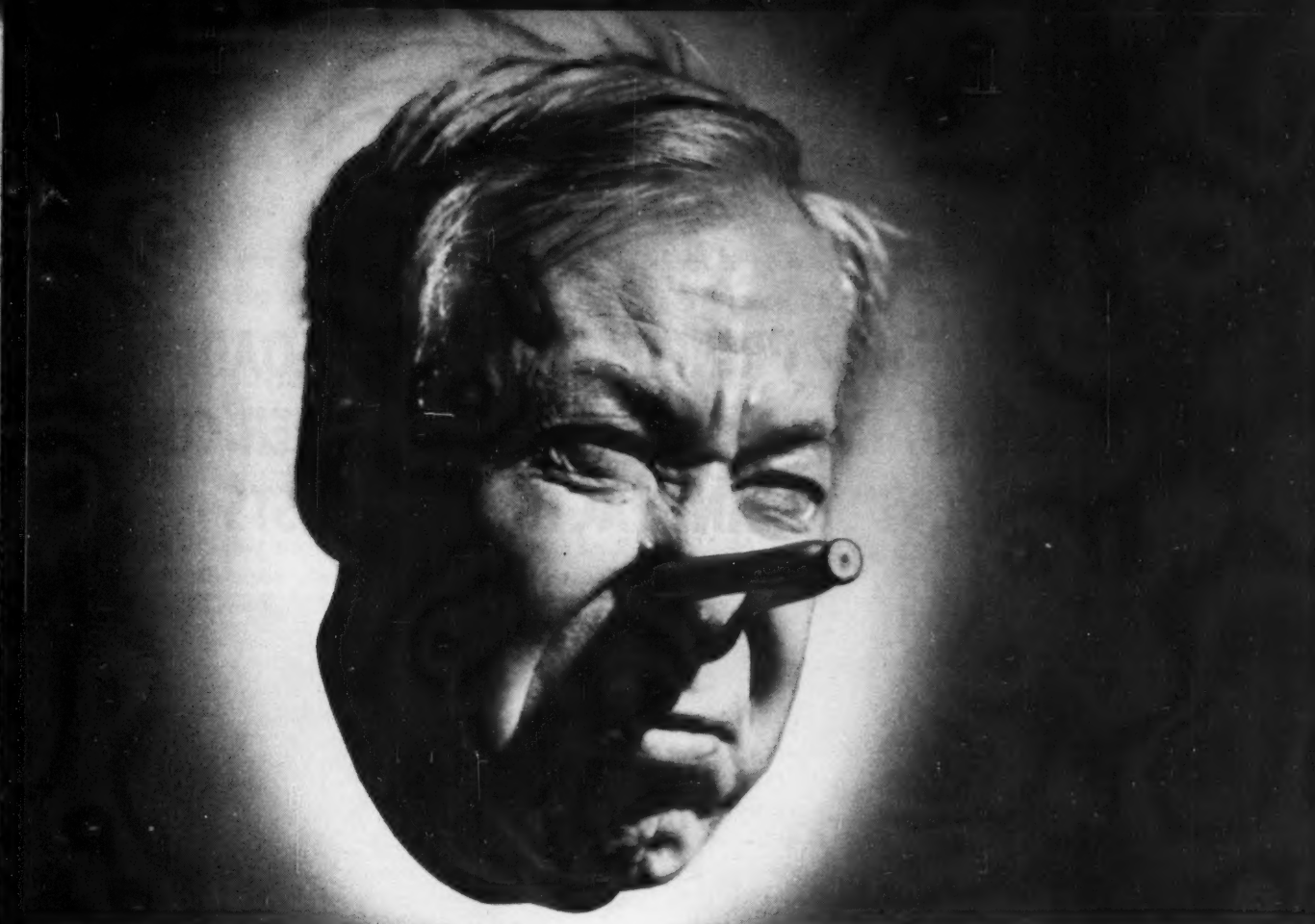
• In many plants where large quantities of duplicate metal parts are being machined substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching in many fields.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building



FOOTBURT

PRODUCTION MACHINE TOOLS



HOW TO DEODORIZE A JOB . . .

Every operator in your shop will realize he has a *better job* when you take the stench out of it. And all you have to do is specify CIMCOOL.°

Cimcool is a radically new and different cutting fluid that virtually eliminates rancidity and foul odors—*even in the hottest weather!* It's a *chemical emulsion.* Can't burn. Can't smoke. Has no objectionable odor of its own.

And those aren't the only reasons why operators like their jobs better when Cimcool is on the job. Cimcool is clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. Contains no skin irritants. And Cimcool cools so fast that tools and chips actually stay cool to the touch. You'll get *better production* when you make *jobs better* with Cimcool!

For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you —without cost or obligation. Or, if you prefer, write for our free booklet "Cimcool Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

MACHINE OF

A NEW *Lo-swing* PRINCIPLE OF WORK LOADING AND WORK TRANSFER WHICH WILL FURTHER CUT TOMORROW'S MANUFACTURING COSTS

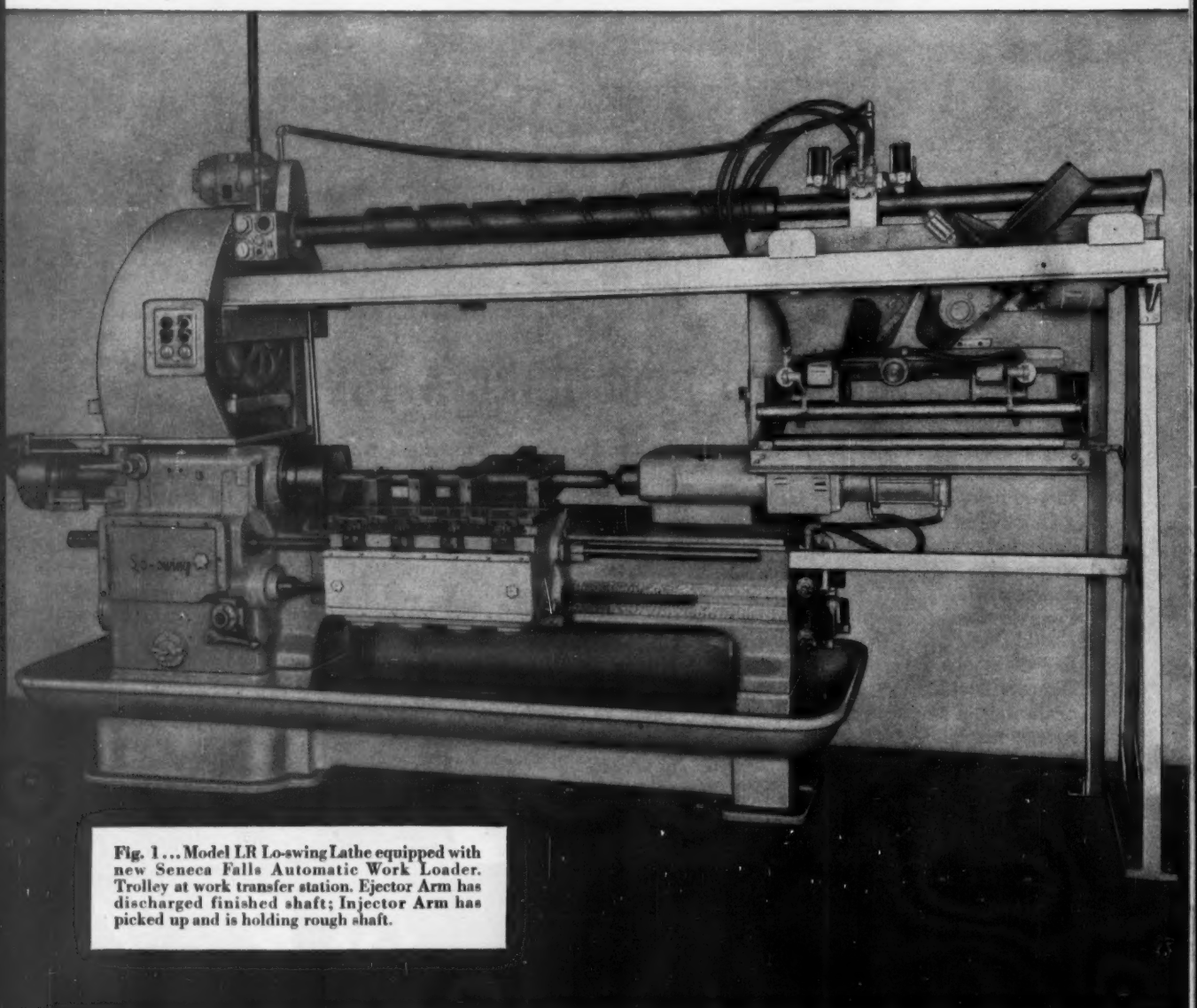


Fig. 1... Model LR Lo-swing Lathe equipped with new Seneca Falls Automatic Work Loader. Trolley at work transfer station. Ejector Arm has discharged finished shaft; Injector Arm has picked up and is holding rough shaft.

PRODUCTION COSTS

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *So-swing* PEOPLE" SENECA FALLS, NEW YORK

THE NEW SENECA FALLS WORK LOADER is designed primarily for handling electric motor, axle and other types of shafts, with or without flanges, in varying lengths. It can also be adapted to handle certain sizes of projectiles.

The loading movement imitates hand loading manipulation, thereby clearing without interference all front and rear tool blocks, the vertical slide attachment, steady rests, and also leaves the front of the machine clear for the tool setter when it is necessary to adjust tools.

The loading trolley, shown in the accompanying illustrations is in a stationary position while the loader arms rapidly remove the finished part and inserts a rough part in position between the centers. On completion of the loading operation, and during the cutting phase of the machine cycle, the trolley moves to the tailstock end of the machine, where the finished shaft is discharged and a rough piece picked up by the loader arms. This movement accomplished, the trolley moves forward to the loading position just as the machine cycle is completed. This feature eliminates loss of time waiting for the loader.

Although the machine is equipped with push button controls for each movement to facilitate set up, the entire loading, machining and ejecting operations are all automatic. This automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding movement. A swinging cradle located at the tailstock end of the lathe connects with work transfer conveyors which feed rough work to the machine and transfer finished work to other machines or gauging stations for succeeding operations.

The significant advantages of this new principle of automatic work loading and work transfer are: assured safety for operator and system; complete elimination of operator's fatigue; wide range adaptability and an impressive acceleration of net output through the entire manufacturing sequence of a given part or product component.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

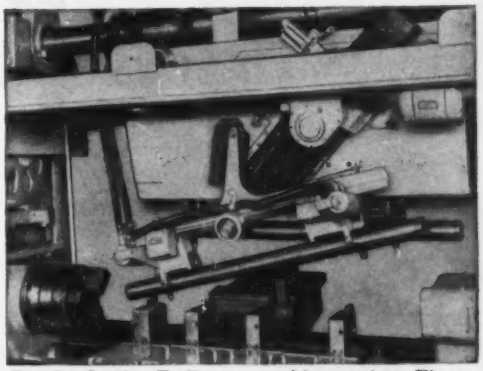


Fig. 2...Loader Trolley at machine station. Ejector Arm has picked up finished shaft. Injector Arm is tipping and lowering a rough shaft. Headstock spindle is stopped, chuck jaws open and tailstock center retracted.

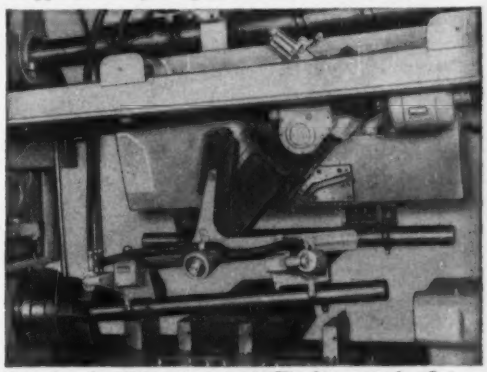


Fig. 3...Conditions same as in Fig. 2, except that Injector Arm is now bringing rough shaft to the horizontal position for entry into chuck jaws. Ejector Arm still holds finished shaft.

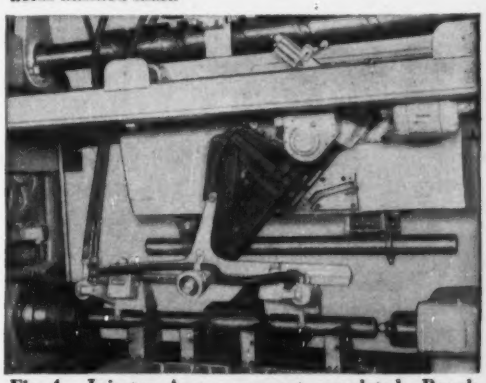
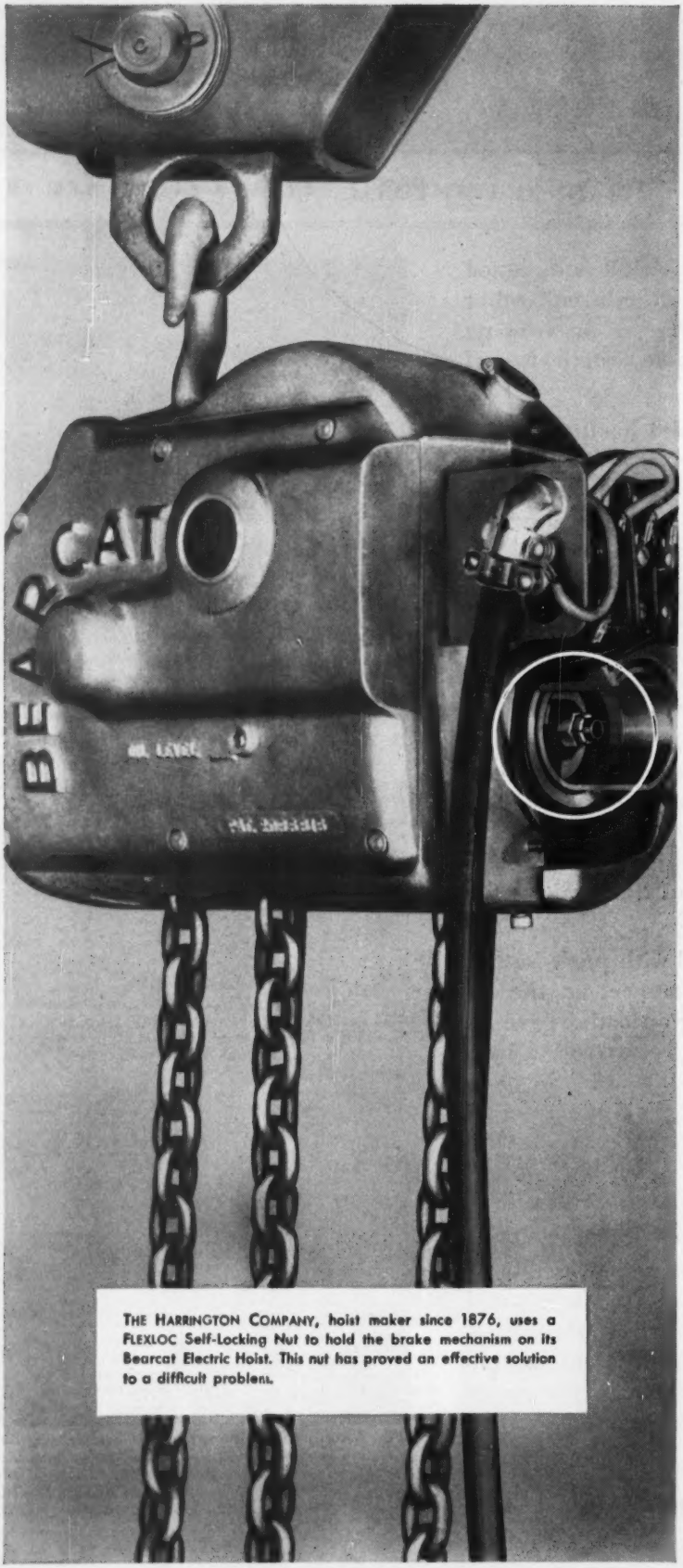
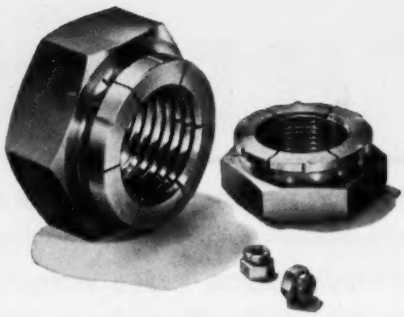


Fig. 4...Injector Arm movement completed. Rough shaft on centers, chuck jaws closed and tailstock spindle advanced. Injector Arm Fingers will next release shaft, and machining begins while Trolley discharges finished piece and returns with the next rough shaft.

ARE LOWER WITH *So-swing*



THE HARRINGTON COMPANY, hoist maker since 1876, uses a FLEXLOC Self-Locking Nut to hold the brake mechanism on its Bearcat Electric Hoist. This nut has proved an effective solution to a difficult problem.



Why FLEXLOCs are better locknuts

Compare the features of FLEXLOCs with those of any other nut, and you'll readily see why we say they are better locknuts.

FLEXLOCs are one piece, all metal. They require no lockwasher, no cotter pin, no auxiliary locking device to keep them on a bolt. They are not affected by moisture, dust or high temperatures. Standard FLEXLOCs are designed for temperatures up to 550° F.

FLEXLOCs are stop and lock nuts. They won't work loose once their locking threads are fully engaged; therefore they stay put anywhere on a bolt. Seating is unnecessary. And FLEXLOCs can easily be removed from a bolt and reused again and again without losing their locking ability.

For more information about FLEXLOCs and samples for test purposes, see your FLEXLOC distributor, or write SPS, Jenkintown 19, Pa.

FLEXLOC®

LOCKNUT DIVISION

SPS

JENKINTOWN PENNSYLVANIA

Our Fiftieth Year : A START FOR THE FUTURE

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to machine shops, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your metal work.

GOOD TWIST FOR ROTOR COUPLINGS

Centering and Holding Simplified by Splined I. D.

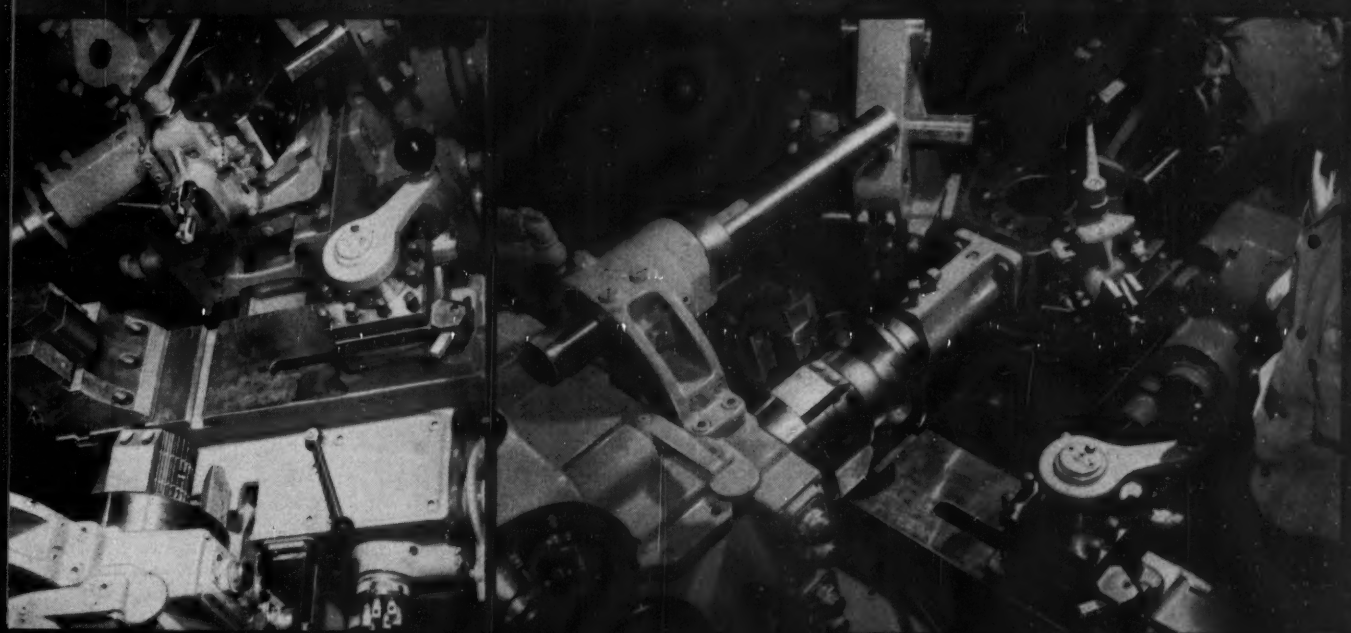
This user solved several problems at once . . . by the application of a splined arbor to chuck these steel shaft couplings for turbine rotors. This method provides the firm holding needed for a heavy forming cut, taper boring and other machining. The machine is a Gisholt No. 4 Ram Type Turret Lathe.

The workpiece is slipped on the arbor against three stops. The splined arbor has a center section that rotates slightly, locking the two splined surfaces snugly to eliminate all play.

The heavy forming cut is done with a dovetail forming tool on the rear of the cross slide. During this cut the workpiece is supported with a live center mounted on the hexagon turret.

The taper attachment is placed on the front of the cross slide carriage and bores the conical inside surface with the cutter in the square turret. The balance of machining is conventional and is done by tools on the hexagon and square turrets.

On this tough steel workpiece, the tolerances are close, a lot of chips are made . . . yet the No. 4 Ram Type Lathe does the job in only 10.7 minutes, f.t.f.



GISHOLT

TIME-SAVING IDEAS

SMART CHUCKING AND TOOLING COMBINE TO CUT COSTS

DANLY Handles 32 Different Parts on ONE Simplimatic

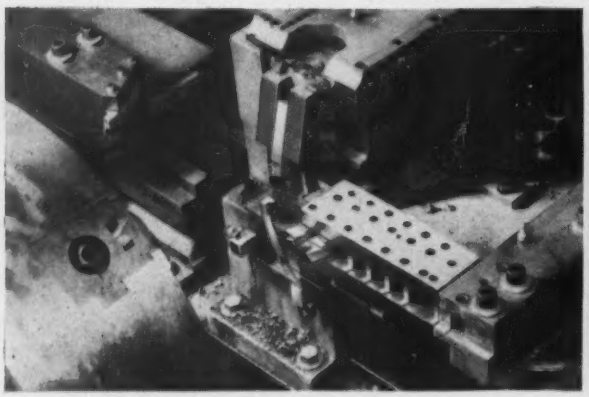
High production of 32 different parts on *one* machine is a neat trick to cut costs—if you can do it . . . particularly when you have square and rectangular shapes to chuck. But Danly Machine Specialties, Inc., largest producer of die maker supplies, is doing it.

The job is machining punch holders . . . and the machine is a 3D Simplimatic Automatic Lathe. The problem of chucking the 32 different sizes was solved by a duplex chuck having two pairs of self-centering jaws which work independently of each other.

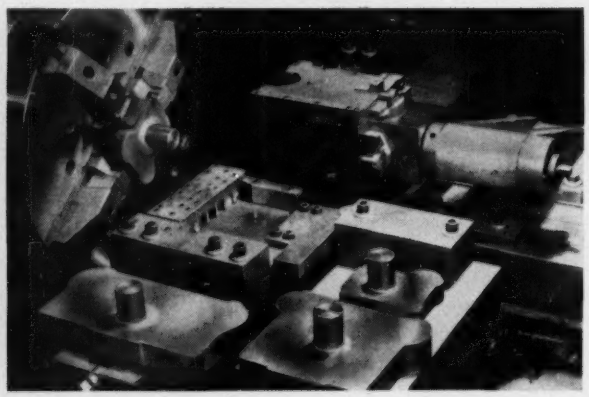
An important aid to production is the front slide with provision for adding tools to accommodate tool travel on the various size workpieces. All 32 types of punch holders are handled simply by inserting or removing tools as necessary.

For the finishing operation, the Simplimatic has a variable speed motor. As the rear slide tool approaches the hub and the diameter diminishes, spindle speed increases. Thus, cutting speed is essentially the same for the entire face of the workpiece.

In this interesting setup, 32 different size parts are handled simply by repositioning chuck jaws and adding tools to the front slide.



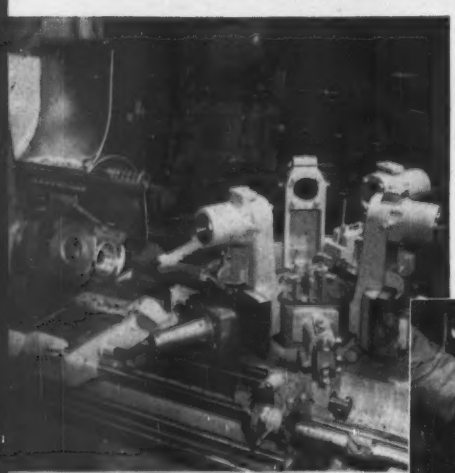
Jaws of chuck operate in pairs to center parts. Note typical workpieces in foreground.



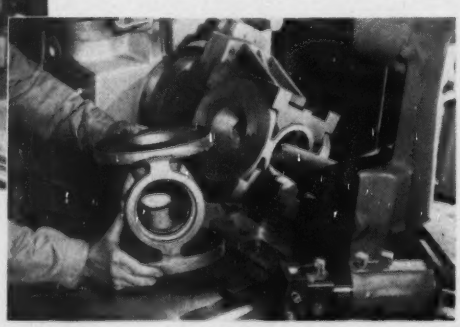
Tooling for machining steel punch holders. Time for workpiece with this setup is only 2.33 minutes.

VALVE BODY PRODUCTION . . . *ON THE DOUBLE*

Features Single Point Tools Instead of Reamer



▲ 2F Fastermatic tooled to machine variety of valve bodies.



Operator holding typical valve body. Note cam-guided boring tool, slide-mounted, on hexagon turret. ▶

Note how this user machines both cast iron and steel plug valves, in a variety of sizes, with this Gisholt 2F Fastermatic Automatic Turret Lathe. The first turret station has a loading arbor to carry the workpiece into proper position for chucking.

Five or six hexagon turret stations are used, depending on the kind of valve body being machined. The tapered seat for the plug is rough and finish bored with single, horizontal slide tools mounted on the hexagon turret. These are guided by an angular cam on the cross slide and held tightly against the cam by sustained air pressure.

In addition to the taper bore for the valve plug, there is boring, facing, and on some workpieces, grooving. Floor-to-floor time for the 2" valve body shown is 11.5 minutes. A single operator easily handles two machines.

The internal taper diameters of these plug valves are bored with repetitive accuracy and finish by cam-controlled single point tools, rather than the usual reamers.

GISHOLT

TIME-SAVING IDEAS

FOUR OPERATIONS ON TWO PIECES WITH SIMPLE CHANGEOVER

Shows Versatility and Speed of No. 12 Hydraulic Lathe

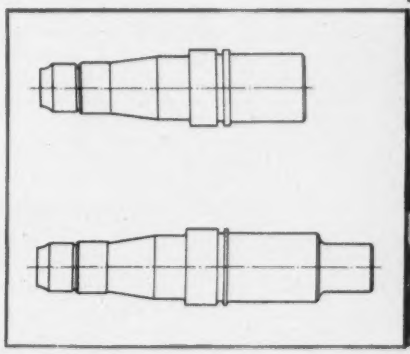
Two different workpieces, each requiring machining on both ends, are handled here with fast, easy changeover. The parts are suspension spindles of nearly equal diameter, but of different lengths. The Gisholt No. 12 Hydraulic Automatic Lathe is the machine handling both.

The parts are held between centers and rotated by an automatic workdriver. Variation in the lengths of the two workpieces is provided for by the use of different tailstock centers. By this method the rear independent slide always remains in the same position—minimizing changeover time. Extra dwell for the rear independent slide tools is obtained through an adjustable stop-block. This is screw mounted on the slide and actuates a switch that starts a timer. The timer operates through the main control valve, returning the slide at the end of the timer cycle.

All turning operations on either end of both workpieces are done from the front carriage. Tools on the rear independent slide handle all grooving, facing and chamfering. Time for the first operation on both spindles is 1.60 minutes. For the second operation, floor-to-floor time is 2.00 minutes for both workpieces.

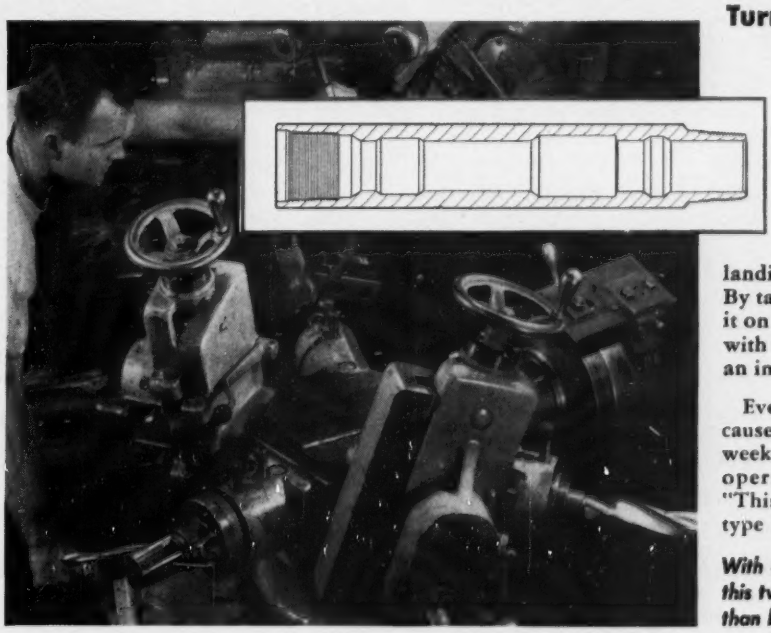
Here's an example of fast, automatic production, with simple changeover on two different parts of varying lengths.

First operation setup for small spindle.
Second operation has similar machining on both size spindles.



SIMPLE SWITCH BOOSTS PRODUCTION 50%

Turret Lathe Brings More Tools to Bear on Work



Setup that increased output 50%

One tool at a time is fine . . . up to a point. When you begin to get into a variety of surfaces, such as here, it's time to change.

That's exactly what Otis Engineering Corporation, Dallas, Texas, did in the machining of these stainless steel landing nipples used in deep oil-well work. By taking the job off an old lathe and putting it on a modern Gisholt 2L Saddle Type Lathe with multiple tooling, they were able to make an immediate production increase of 50%.

Everybody is happy about it: The firm, because the machine gives a full 95 hours per week of *lower-cost* production — and the operator, Richard N. Crawford, who says, "This is one of the best turret lathes of any type I've ever operated."

With all stations of the hexagon turret working, this two-operation job is completed 50% faster than by old method.

GISHOLT

TIME-SAVING IDEAS

SOLVED: *A WEIGHTY BALANCING PROBLEM*

5-Ton Turbine Rotors Corrected to Accuracy of 2 Ounce-Inches

De Laval Steam Turbine Company, Trenton, N. J., had a three-fold problem in balancing these large marine turbine rotors:

1. Accurate balancing
2. Correction at a rapid rate
3. Prevent scoring of journals

By dropping an older method and doing the job on a Gisholt DYNETRIC Balancer, De Laval answered all three requirements with one machine. The 16-stage rotors weigh 10,000 lbs. and measure 95" in length and 70" in diameter.

The balancing and correction functions are tied together. The rotors are balanced to an accuracy of 2 ounce-inches by making correction on two balance rings: On one, excess metal is ground off the heavy side. On the other, where it is not possible to remove material, correction is made by adding plugs of predetermined weight to tapped holes.

In the former balancing method, journals were scored as a result of being carried on rollers. This made it necessary to refinish the journals after balancing. The Gisholt Balancer ended this trouble because the workpiece is properly carried on half bearings.

As to the performance of the Gisholt Balancing Machine, the manufacturer reports, "This Gisholt Balancer replaces one of another type. We now have a safer and faster operation to give us the accuracy we require. The half bearings in the work support have eliminated the scoring of journals."

Faster, more accurate balancing of rotors by this Gisholt DYNETRIC Balancer pays off in smooth, vibrationless operation, longer life.

DYNETRIC BALANCERS

THE GISHOLT BALANCING SCHOOL *teaches the supervisor to plan for faster setups, quicker changeover, and how to get more out of balancing equipment in every way. Write for information. Classes now in session.*

SUPERFINISHING IMPROVES QUALITY OF TRANSMISSION PARTS

Faster, Less Costly Than Former Process

In one fast, automatic operation, Superfinish rids vital bearing surfaces of smear metal, grinder flats, etc., to insure smoother, longer life. Here's not only low production cost, but also low machine investment.

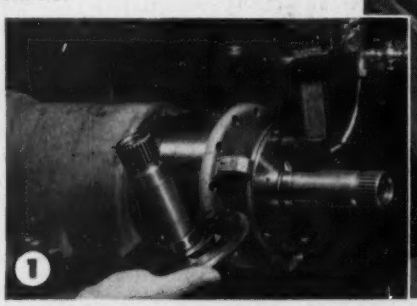
How to achieve fine finish on these high-quality automatic transmission parts? This manufacturer turned to Superfinish—for speed, efficiency and low cost.

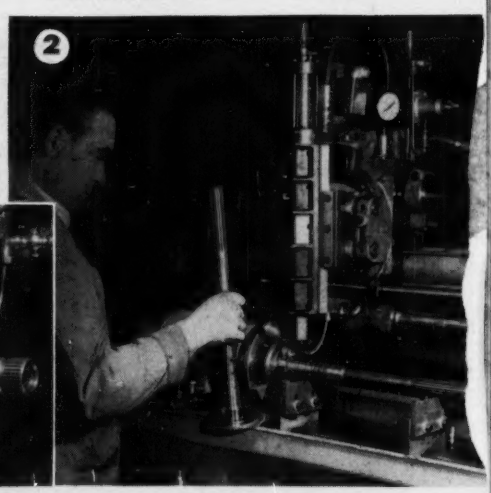
Here's how it's done:

First photo shows a flanged hub in the Gisholt 52-A Superfinisher. To hold the assembly, the chuck is mounted on a special face plate. The Superfinish Stone-Carrying Quill has extra travel to provide clearance for easy loading and unloading. For Superfinishing the bearing surfaces, two speeds are used—a 10-second roughing cycle and a 15-second finishing cycle. Except for the loading and removing of parts, the machine is fully automatic with a predetermined and adjustable cycle.

To do the shafts shown in the second photo, changeover is this quick and easy: The chuck is removed, and a standard driving plate is mounted on the spindle. Loading of the longer workpiece is aided by two adjustable loading rails. The workpiece is held between a headstock dead center and a tailstock live center.

Superfinishing cycle-time is the same for both parts. Production is at the rate of 70 per hour at 80% efficiency. In both cases, bearing surfaces are Superfinished to 3 to 4 micro inches R.M.S. from a ground finish of 15 to 20 micro inches R.M.S.





No. 7-853
613

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

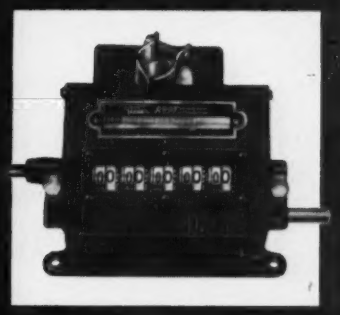
Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

You get what you set...



Added Evidence that—

Everyone Can Count on VEEDER-ROOT

Set the predetermining wheels for any run you want. Then, when the counting wheels reach the pre-set number, an electrical contactor makes or breaks the circuit to light a light, ring a bell, or trigger a stop-motion. Yes, this V-R Predetermining Counter is an efficient variable control for *many* types of stop-motion. Short runs and over-runs are prevented on a wide range of machinery, from coil winders to textile looms. Now, figure out how *you* can use this Cost-*Count*rolling Counter. Then write:

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Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C.
Montreal 2, Canada • Dundee, Scotland
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"Counts Everything on Earth"

you have precision problems, too!

As swift technical advances are made, they bring new and interesting production problems. That illustrated is a good example. Axelson, with its experienced designers and engineers, is assisting more and more firms in the solution of their metal turning problems. Axelson lathes are well known for their ability to sustain heavy loads over long periods, to produce precision work with accuracy. Axelson designers and engineers contrive special attachments that answer Industry's need for intricate work. If you want a solution to the problem worrying you, get in touch with Axelson or your nearby Axelson representative.

Write for Axelson Lathe Bulletin #5304.

Chosen first....to last! **AXELSON** *Lathes*

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

TOOL ROOM LATHES • GAP BED LATHES • HEAVY DUTY ENGINE LATHES

AXELSON MANUFACTURING COMPANY • Division of Pressed Steel Car Company, Inc. • Los Angeles 58 • New York 7 • St. Louis 16

Authorized Distributors in All Principal Industrial Centers

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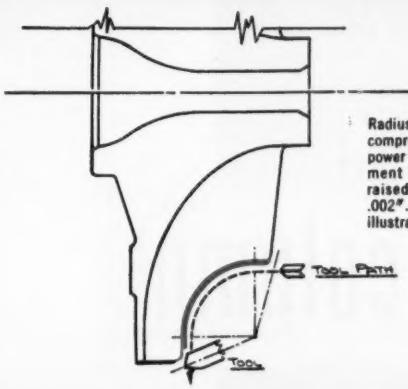
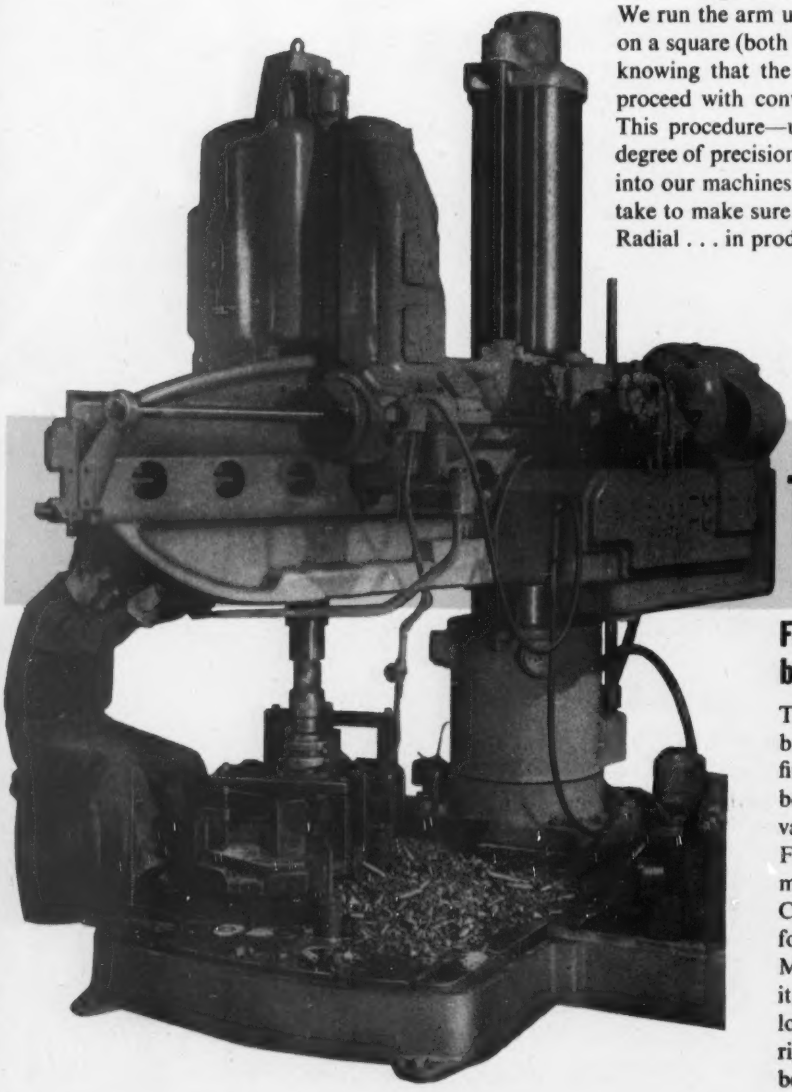


Radius contouring of 35.8" diameter jet compressor rotor with specially designed power operated radius turning attachment on standard 32" Axelson lathe raised 4". Tolerance specification is .002". Unusual tool path of radius is illustrated in diagram.

Here's another reason it pays to get a proposal from Fosdick

Fosdick aligns the column

Radial alignment at Fosdick starts with the column. We run the arm up and down with an indicator bearing on a square (both lengthwise and across the base). Then, knowing that the column is square with the base, we proceed with conventional tramming and sweep tests. This procedure—used only by Fosdick—adds an *extra* degree of precision to the extra rigidity we have designed into our machines. It's another example of the pains we take to make sure you get the most out of your Fosdick Radial . . . in production, tool life, finish, tolerance.



Fosdick Hydraulic Radials are available with 3′ to 8′ arms, 11″ to 19″ columns. For full information, ask for Bulletin **HRM**

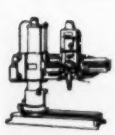
to give you

Fosdick takes a "bite" out of boring time at Owen Bucket

Tough cast-steel hinges for clamshell buckets are bored to ± .001″ for a press-fit cast iron bushing—then counter-bored for a washer. For this and a variety of other heavy-duty drilling, Fosdick's proposal on a 5′ 17″ Radial made sense. Now Owen Bucket Co. of Cleveland gets 10 pieces in the time formerly needed to produce 7. As Frank Matisak, General Superintendent puts it, "... now we can do more pieces with longer tool life—this machine is more rigid, giving us closer tolerances and better finish."

First precision production like this

Need Drilling Equipment? Get a Proposal from Fosdick!



Radial Drills

Jig Borers

Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

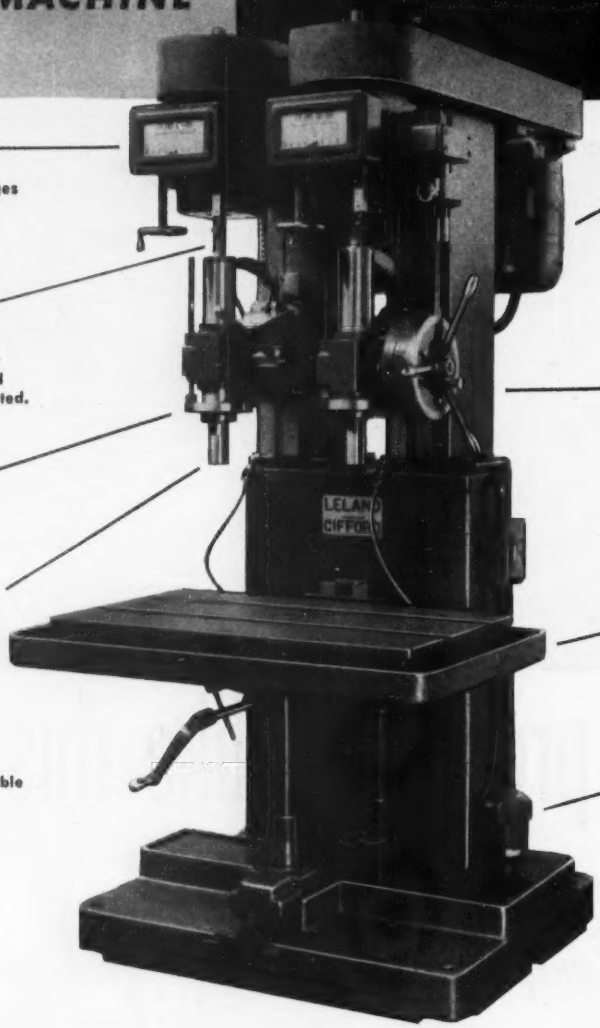
FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

ALL THE FEATURES YOU WANT IN A HEAVY DUTY DRILLING MACHINE

the new

LELAND-GIFFORD No. 3 MVB



Leland-Gifford indicating shift for instant speed changes without stopping machine.

20-tooth involute spline spindle for greater rigidity, less wear. Independently counterbalanced and continuously lubricated.

Flanged quill for mounting multiple (spindle) heads.

Capacity of No. 3 or No. 4 Morse Taper.

Base, column and table ruggedly built for maximum rigidity.

Totally enclosed, fan cooled, ball bearing NEMA motor mounted at rear and driving through V belts.

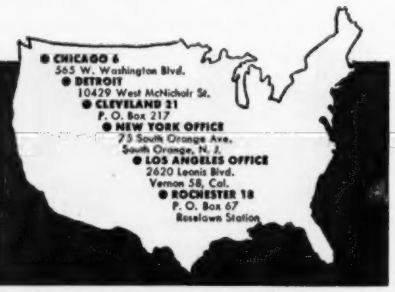
Semi-automatic power feed with 3 feed rates, automatic adjustable depth stop and safety slip clutch. Hand or hydraulic feed also available.

New design table with removable top for easy refinishing.

Coolant pump and tank readily accessible for cleaning.

24" SWING
1 to 4 SPINDLES

Write For Complete Information

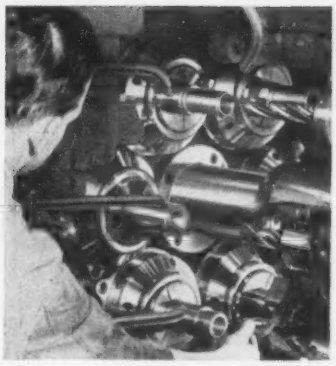


LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

No. 1 in a Series



"He who makes no mistakes does nothing"

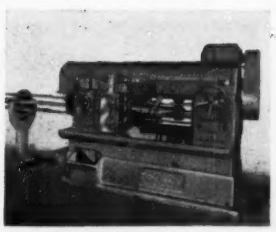
In a supposedly modern era it is sometimes claimed to be "smart business" to let a competitor take the lead and make profit from his mistakes. Obviously, if all business adhered to such a philosophy there would be no progress, if any business. "He who makes no mistakes does nothing". Cone leadership was founded — and is maintained — by active service, by doing things.

The Conomatic Carbide Development program expects to make a few mistakes. But, loss or gain, its efforts will contribute to the general benefit of all "automatic" users, users on whom all "automatic" builders are dependent.

The job illustrated compares actual production runs with HSS and 100% carbide tooling. It suggests the kind of pioneering that is being done at Cone. Full details are available.

MATERIAL—1112 STEEL: Hole drilled with 1" dia. drill to 2¼" depth. OD threaded to 2" length with 1¼"—12 chasers.

	HSS	CARBIDE
Cycle Time	90 secs.	15 Secs.
Work Spindle Speed	370 R.P.M. at 103 S.F.	1500 R. P. M. at 417 S. F.
Tool Wear	1500 pcs. per grind	5000 pcs. per grind



Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Are space and weight savings vital?

here's how leading aircraft manufacturers get them with NEEDLE BEARINGS

Torrington Needle Bearings are integral design features in many leading aircraft because of their light weight and compactness coupled with their high rated radial capacity.

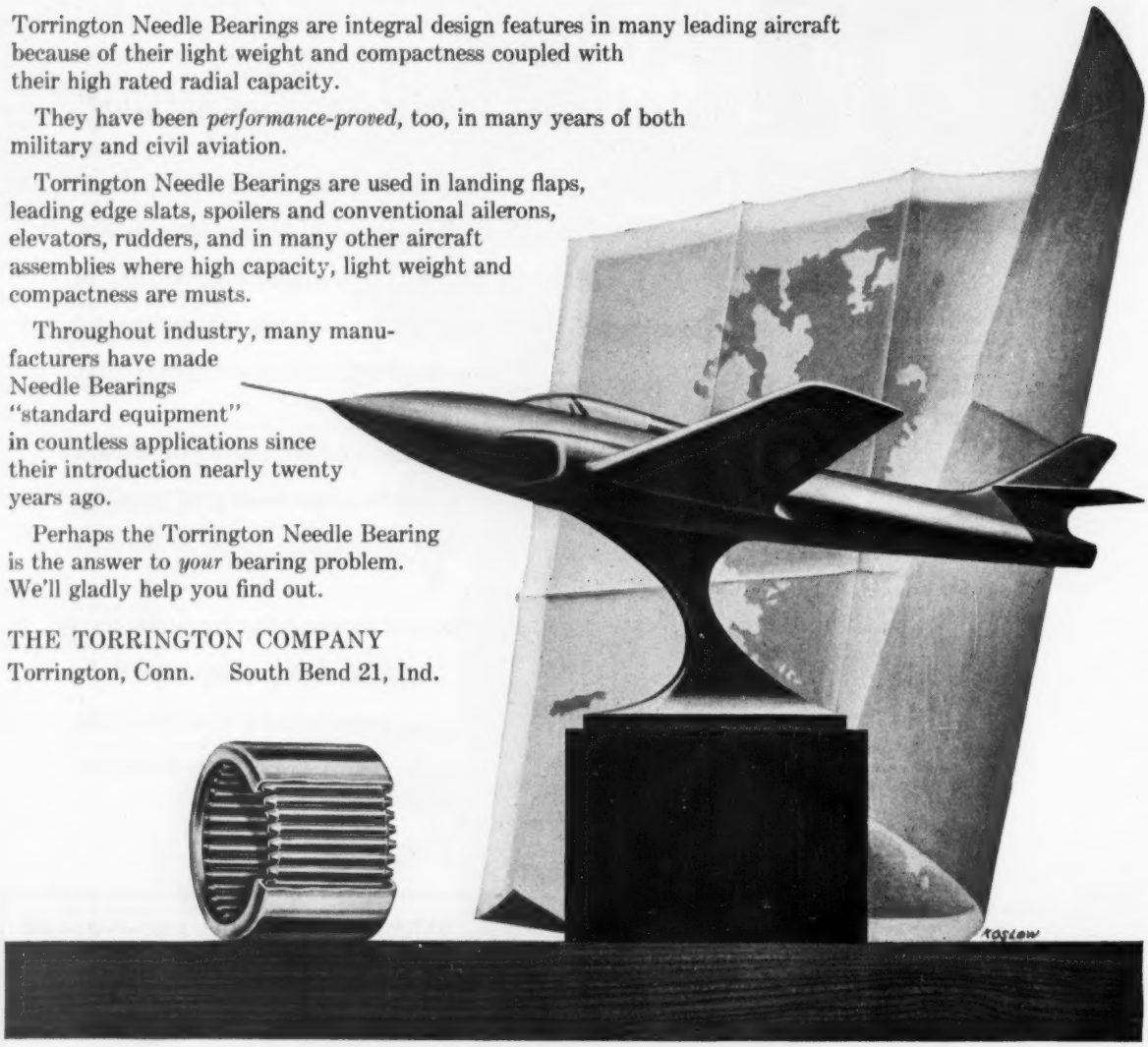
They have been *performance-proved*, too, in many years of both military and civil aviation.

Torrington Needle Bearings are used in landing flaps, leading edge slats, spoilers and conventional ailerons, elevators, rudders, and in many other aircraft assemblies where high capacity, light weight and compactness are musts.

Throughout industry, many manufacturers have made Needle Bearings "standard equipment" in countless applications since their introduction nearly twenty years ago.

Perhaps the Torrington Needle Bearing is the answer to *your* bearing problem. We'll gladly help you find out.

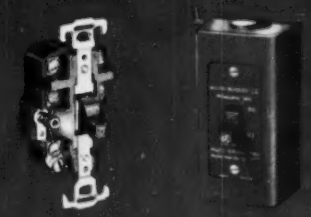
THE TORRINGTON COMPANY
Torrington, Conn. South Bend 21, Ind.



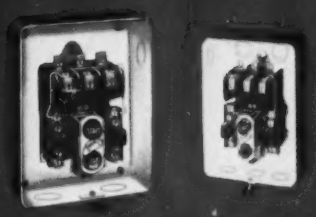
TORRINGTON *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

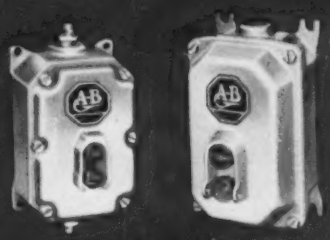
Trade-marks of leading aircraft companies whose products enjoy the benefits of Needle Bearings.



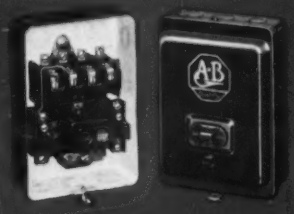
Bulletin 600
Starting switch for small motors. With or without pilot lights.



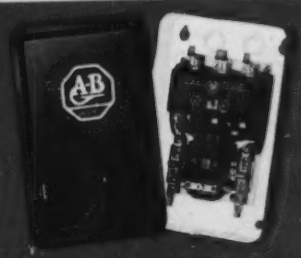
Bulletin 609
Manual starter for a-c motors. Up to 5 hp, 220 v; 7½ hp, 440-550 v.



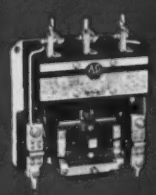
Bulletin 809 Enclosures
NEMA Type 7 for hazardous gases. NEMA Type 4 for watertight duty.



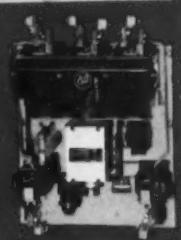
Bulletin 709 Solenoid Starter
Form 1—Push buttons in cover
Form 2—Without push buttons
Form 3—With 3-way selector



Bulletin 709 Solenoid Starter
Size 2—NEMA Type 1 steel enclosure.

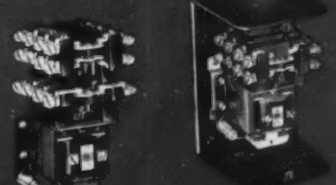


Bulletin 709 Starter
Size 4—Open type.

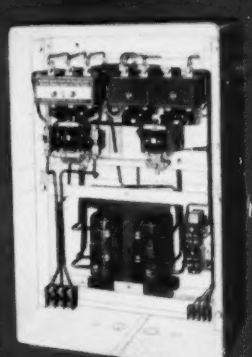


Bulletin 709 Solenoid Starter for motors up to 300 hp, 220 volts; 600 hp, 440-550 v. These starters are available in enclosures for any industrial service.

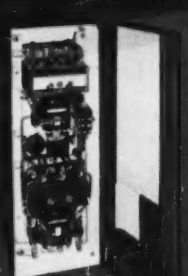
Bulletin 700 Type C
small 2-pole relay.



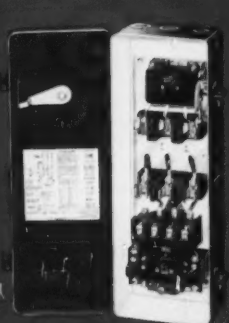
Bulletin 700 Type BX Relays
8-pole open. 4-pole enclosed.



Bulletin 740 Automatic Autotransformer Starter for squirrel-cage motors.

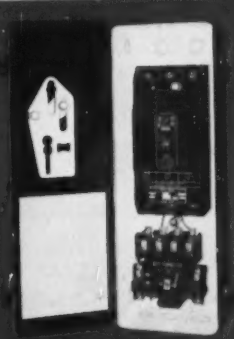


Bulletin 740
Automatic 3-Step Resistance Starter.
Starters also available in 2-steps or for stepless acceleration.



Bulletin 712
Combination Starter with manual disconnect and fuse clips. (Left)

Bulletin 713
Combination Starter with ITE circuit breaker. (Right)

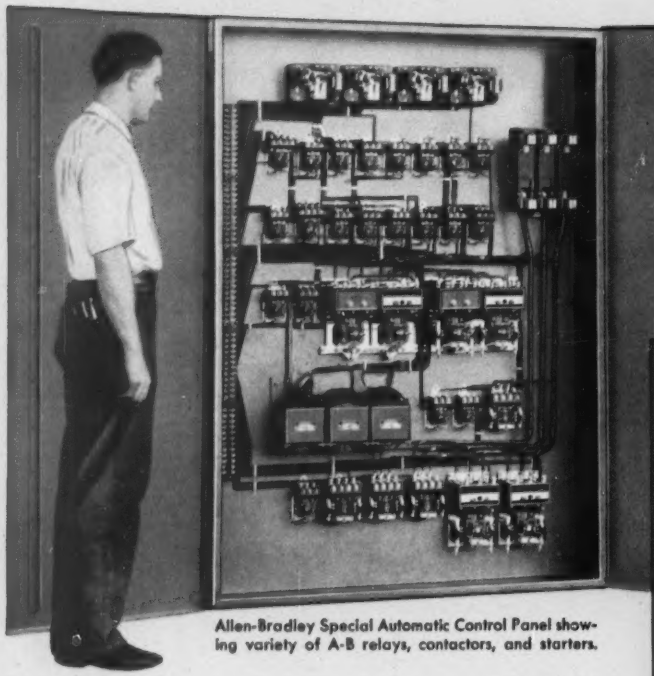


THE QUALITY SIGN in Motor Controls

The A-B trademark is recognized, everywhere, as a symbol of QUALITY in motor control and a guarantee of trouble free performance in all types of industries. Allen-Bradley engineering progressiveness blazed the trail of the solenoid starter. And Allen-Bradley still leads the field with solenoid starter performance in 8 sizes—up to 300 hp, 220 v; 600 hp, 440-550 v. Such leadership assures you maximum production from your motorized machines.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY
TROUBLE FREE MOTOR CONTROLS
QUALITY



Allen-Bradley Special Automatic Control Panel showing variety of A-B relays, contactors, and starters.

A-B Quality

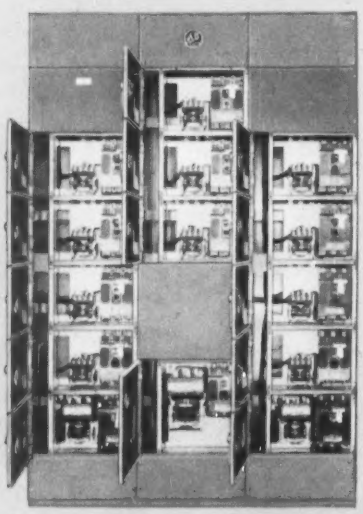
Let this **TRADEMARK** be your guarantee of **TROUBLE FREE OPERATION** for Large or Complex Control Installations

Are you looking for efficient and trouble free starters for large motors, or do you have a complicated control problem?

If so, you can be assured of the most modern and dependable equipment by calling in your nearest A-B control engineer. He has the experience and know-how to select the *right* combination of motor controls for each application.

Allen-Bradley controls are simple in design... hence more dependable and trouble free. The A-B trademark is a guarantee of QUALITY that safeguards manufacturing schedules. We shall be glad to send you an illustrated bulletin describing the Allen-Bradley line.

MULTI-UNIT PANELS FOR CENTRALIZED MOTOR CONTROL



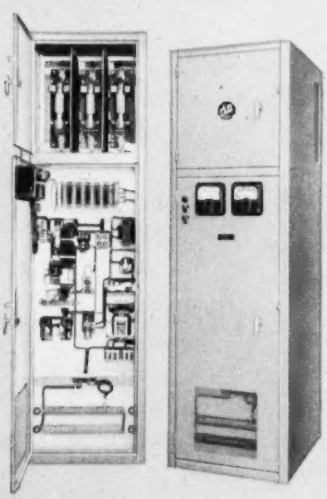
Many modern plants concentrate their motor controls in a centralized group of panels . . . all enclosed in a sectionalized steel control center.

For full particulars about Allen-Bradley Multi-unit Control Centers, please ask for Bulletin 798. Units can be removed or changed without disturbing the other controls.

STARTERS FOR LARGE LOW & HIGH VOLTAGE MOTORS

Manual or automatic starters are available in the Allen-Bradley line of motor controls for large low voltage and high voltage squirrel cage and synchronous motors.

Manual or fully automatic starters with any special feature, such as indicating lights, can be furnished. For complete data, send for illustrated bulletins.



Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

TROUBLE FREE MOTOR CONTROLS

6-53-R

FARVAL—*Studies in Centralized Lubrication* No. 142

FARVAL SAVES DOLLARS

and many production hours on 4 Minster presses

THE press room is the bottleneck in any sheet metal plant. If presses are shut down for oiling or repair of bearings due to faulty lubrication, the entire manufacturing operation grinds to a halt. Production is lost.

To avoid these troubles in its plant, Lyon Metal Products, Inc. installed Farval centralized systems of lubrication on their four Minster presses. The results were immediate: Farval resulted in considerable savings in labor and lubricant over a three-year period. But better than that, Farval freed these presses for their real work of high-speed, non-stop production by eliminating the "human element" involved in frequent shutdowns for lubrication. Now, with a quick stroke, all points (regardless of location) on a machine are lubricated properly, effortlessly. In addition, the Farval system is sealed against dust and scale which inevitably get into bearings with old-fashioned oiling methods.

Farval is the original Dualine system of centralized lubrication that delivers oil or grease under pressure to a group of bearings from one central station, in exact quantities, as often as desired. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble.

Today, Farval is working in hundreds of metalworking and processing shops protecting bearings on presses, coilers, shears—in fact, every type of equipment that must be lubricated regularly and properly.

If you want to lower production costs in your plant, you owe it to yourself to look into Farval. The savings will amaze you. Write today for free Bulletin 25. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

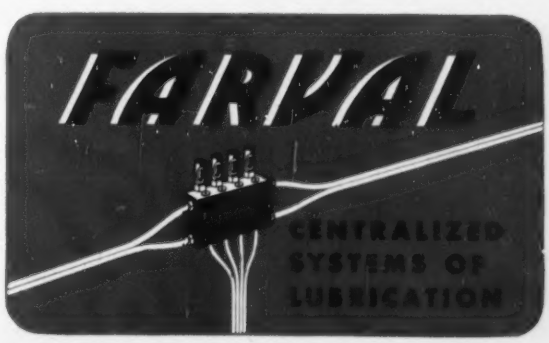
KEYS TO ADEQUATE LUBRICATION— Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know that a machine will be properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

FARVAL SAVES ON LUBRICATING 4 PRESSES
(Savings based on one work shift per day)

	Lbs./Yr. lube. 64 points	Hrs./Yr. lube. 64 points
GREASE GUN	576 lbs.	208 hrs.
CENTRALIZED SYSTEM	144 lbs.	52 hrs.
SAVINGS EFFECTED IN 3 YEARS BY FARVAL	1296 lbs.	468 hrs.

AND IN ADDITION, FARVAL SAVES BEARING EXPENSE AND PRODUCTION TIME

Reports of lubrication engineers show lubrication by grease gun takes .747 minutes per point to clean dirt from nipples, grease, move from point to point and refill gun. With Farval it only takes .188 minutes per point to fill reservoir, build up and hold pressure, and lubricate. In addition, Farval saves 3 pounds of each 4 of lubricant used by other methods.

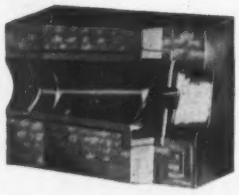


For Jet Blades and for YOU...

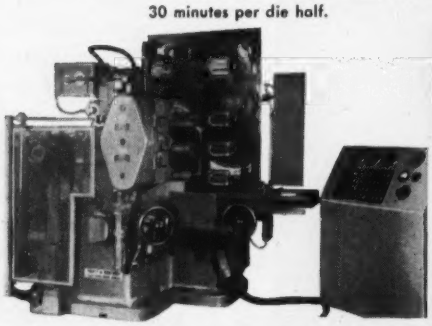
PRATT & WHITNEY

HERE IS THE COMPLETE METHOD FOR MASS-

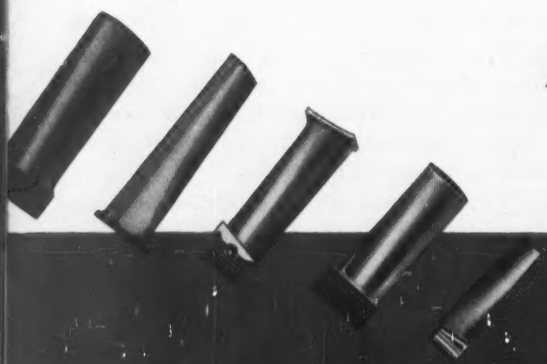
JET BLADE FORGING DIES



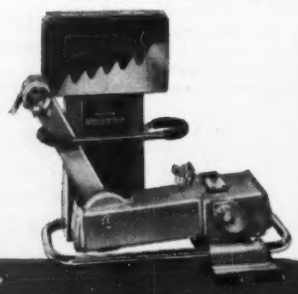
1 **ROUGHING DIE BLOCKS with the PRATT & WHITNEY-KELLER MACHINE** This P&W, Type BL-3620, 3-Spindle Keller Machine is performing the roughing operation on three male die halves at once; the female halves are similarly handled. Average machining time is only about 30 minutes per die half.

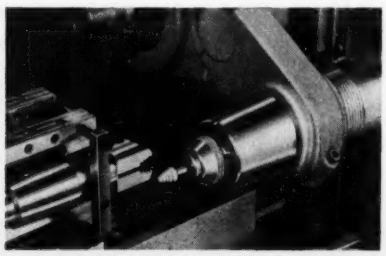


FINISHING JET BLADES



1 **FINISHING THE FIR TREE FORM on ROOT SECTIONS or BLADE CARRIERS with wheels formed on the PRATT & WHITNEY DIAFORM Wheel Forming Attachment** The fir tree form for this blade carrier is being ground with a wheel that was accurately formed to "tenths" in a few minutes with a Pratt & Whitney Diaform Wheel Forming Attachment. Grinding wheels for root sections are formed with equal speed and accuracy.





It's Logical to Look to

PRATT & WHITNEY

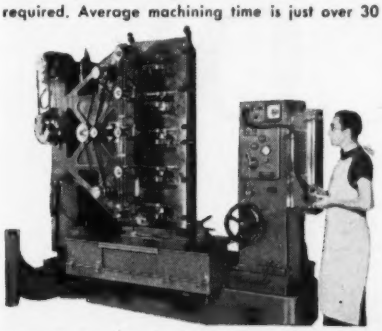
This example illustrates how a part of the diversified Pratt & Whitney Machine Tool line — backed up by P&W Gage and Cutting Tool Engineering Service — can break a critical production bottleneck. The jet blade production method shown here has been described by manufacturers using it as, "... by far the most accurate." What P&W has done for jet blade production it can do for your tough manufacturing problems.

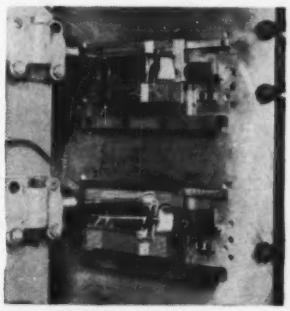
If you would like complete information about any of the equipment shown here — or if we can help you to solve a specific problem — write on your Company letterhead to the Pratt & Whitney Branch Office nearest you, or direct to West Hartford.

MEANS RESULTS

PRODUCING AND FINISHING TURBINE BLADE AIRFOILS

2 **FINISHING DIE BLOCKS TO ± .002 INCHES with the PRATT & WHITNEY AUTOMATIC DUPLICATING MACHINE** The 4-Spindle Pratt & Whitney Automatic Duplicating Machine is finish machining a set of four female die halves for a deeply curved turbine bucket. Hand polishing is needed only to remove mill marks; no hand correction of airfoil shape is required. Average machining time is just over 30 minutes per die half.





3 **CORRECTING DIES AFTER HARDENING**

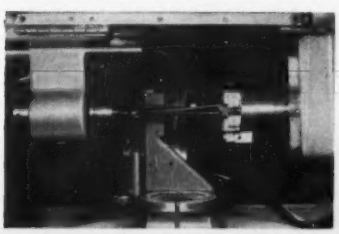
Dies are often unavoidably distorted in hardening to the usual Rockwell "C" 60-63. Since P&W Kellerflex Carbide Burs are used in this machine, these dies can easily be replaced in the P&W Automatic Duplicator and re-cut if necessary.

2 **GAGING FIR TREE FORMS with the PRATT & WHITNEY AIR-O-LIMIT GAGE**

Checking fir tree forms for pitch diameter with this P&W Air-O-Limit Gage is far faster and more reliable than the previous method of checking over wires with a hand micrometer. Air-O-Limit Gaging is available for both blade and carrier forms.

3 **FINISH GRINDING AIRFOIL SECTIONS TO ± .003 INCHES PRATT & WHITNEY TURBINE BLADE AIRFOIL GRINDER**

The *entire* twisted and irregular airfoil section of this blade—including leading and trailing edges—is being ground in a single automatic operation on a P&W Airfoil Grinder. A fine finish with closely maintained tolerances is produced.



PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

First Choice for Accuracy

Branch Offices . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stacey Co.) • DETROIT • HOUSTON (The Stacey Co.)
LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS • CUTTING TOOLS • GAGES

Bring out the hidden profits in your rough grinding with the

"TOUCH OF GOLD"

Too often rough grinding is regarded as a necessary evil, a red ink entry on the production ledger.

The fact is that rough grinding jobs *can* be — and *should* be — as definite money-making operations as any other form of grinding.

And they *will* be when you add the "Touch of Gold" with Norton wheels that are exactly right—as to abrasive, bond and every other detail—for the work you're doing on the machines you're using.

Then you'll grind off more metal per dollar, increase production and cut costs every day, on countless routine jobs.

And you'll realize that the *hidden profits* in your rough grinding operations need only this time-and-money-saving "Touch of Gold" to bring them to light.

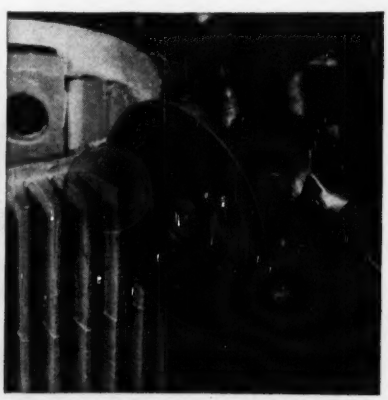
Your Norton Distributor

can bring long, practical experience to your rough grinding problems. If necessary, he'll call in your Norton Abrasive Engineer for expert advice on any new or difficult applications. Backed by the world's largest manufacturers of abrasives, with the broadest line to choose from, these Norton men will make sure you get exactly the wheels you need for best results.

Ask your Norton Distributor for Booklet No. 1405 . . . 54 illustrated pages covering every phase of rough grinding. Or write direct to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities — listed under "Grinding Wheels" in your telephone directory yellow pages. *Export:* Norton Behr-Manning Overseas Inc., Worcester 6, Mass.

On floor stands you grind faster, at lower cost with Norton ALUNDUM or CRYSTOLON wheels. There's a right Norton abrasive-and-bond combination for every metal, every job.

On portable grinders the smaller Norton wheels do the same big job of cost cutting. With their inbuilt balance they *hug that work* — to grind more metal per man-hour.



On many jobs the versatile Norton Nylon-Reinforced Hub Wheels — BD rigid and BFR semi-flexible—are the fastest, easiest, *safest* wheels to use. They're ideal for weld grinding and similar finishing operations.

On swing frame grinders Norton wheels stand up under heavy grinding pressures at high speeds, combining fast, clean cutting action with extra long wheel life. For high tensile strength metals use ALUNDUM* abrasive; for low tensile metals, CRYSTOLON* abrasive.

NORTON
ABRASIVES

Making better products . . . to make other products better

W-1497

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

Machining Time on Pump Casings Cut 45% at De Laval Steam Turbine Co.

FOR DEEP BORING:

The Simmons 6" Boring and Facing Machine

When installed in De Laval's boring department, the Simmons 6-in. Bar Horizontal Boring and Facing Machine proved itself in no time.

In boring and facing single-stage pump casings, it cut previous average machining time by 45%. And in machining worm gear cases, machining time was cut by 50%.

"The Simmons machine has all the horsepower we need," says De Laval's foreman of the boring department. "In fact, it has the horsepower, the speeds and feeds we need for carbide tooling. And that's why we've been able to boost our output so substantially."

There's really no such thing as *the* Simmons 6-in. Boring and Facing Machine. It's actually many machines—all based on the same unit-type construction, but each adapted to the special needs of different manufacturers. It can be adapted to your needs, too, no matter what your deep-boring job. Write for details.

CHECK THESE FEATURES

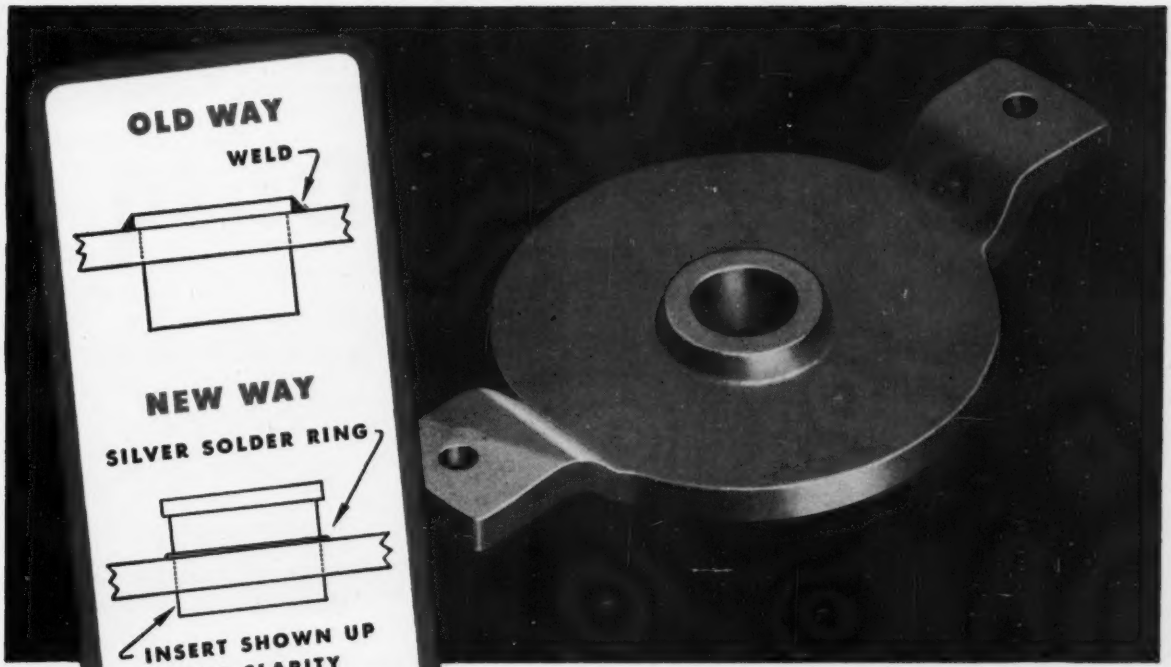
1. Automatic, continuous facing head permits high-speed facing with carbide tools.
2. Hydraulic feed to entire head in addition to normal bar feed.
3. Boring head fed to and from work reduces overhang of boring bar to a minimum—resulting in greater accuracy.
4. A range of bar speeds between 3 and 200 rpm and bar feeds from 0.0005 in. to 0.500 in. per revolution can be supplied.
5. Up to 50 HP motor drive.
6. Precision anti-friction bearings used throughout.
7. Standard bar length is 17 ft.; travel in one setting is 72 in. Bed lengths and widths supplied to your needs.
8. Unit-type construction enables basic boring and facing unit to be adapted to your special requirements.

SIMMONS MACHINE TOOL CORPORATION

1600 North Broadway, Albany 1, New York

New York Office: 50 East 42nd St.

Pittsburgh Office: PEnhurst 1-3700 Philadelphia Office: VIctor 8-3133



Assembly Cost *Cut 32%* with TOCCO* Induction Brazing

Now's the time to balance YOUR production budget

This assembly may bear no resemblance to your product, but its case is typical of the savings accomplished by Induction Heating of metal parts of all sizes and shapes.

Formerly the Norris Thermador Corporation used arc welding to join the bushing and clamp shown above. In an effort to reduce costs TOCCO Induction Heating was brought into the production picture with the following results:

OLD METHOD (Arc Welding)		**NEW METHOD** (TOCCO Induction Brazing)	
Material (rod)	$ 4.56 per M parts	Material (solder and flux)	$13.83 per M parts
Labor	20.63 per M parts	Labor	8.82 per M parts
Overhead	21.25 per M parts	Overhead	9.08 per M parts
Total Cost Old Method	$46.44 per M parts	Total Cost TOCCO Method	$31.73 per M parts

TOCCO Engineers are glad to survey your operations for similar cost-cutting results — no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

TOCCO

Mail Coupon Today

NEW **FREE** BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-7, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering."

Name_____

Position_____

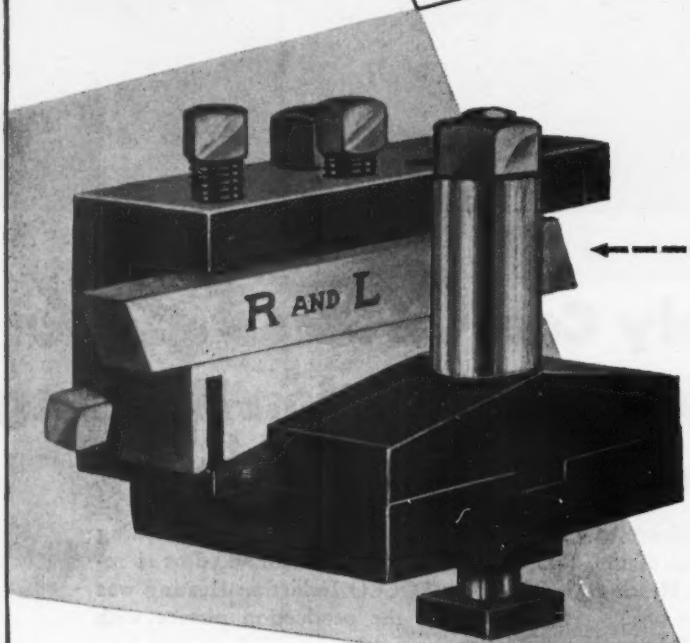
Company_____

Address_____

City_____ Zone____ State_____

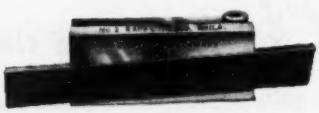
DOUBLE Duty

R and L UNIVERSAL TOOL POST



specially designed

The R and L Cut Off Blade Holders are precision made to flawlessly fit in the Universal Tool Post.



More than just a tool post! The R and L Universal Tool Post is made by men who completely understand your shop problems. Precision manufactured to hold square or flat tools, providing the means for adjusting the tool in all directions. Can be used close to the chuck, on front or back cross-slide with spindle running forward or backward.

Write today for the new R and L Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • TAP AND DIE HOLDER • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL
KNURLING TOOL • CARBIDE AND ROLLER BACKRESTS • RELEASING ACORN DIE HOLDER • REVOLVING STOCK STOP • FLOATING DRILL HOLDER

S. S. *United States* and Lower Manhattan, New York City — Robert Yarnall Richie Photo

The Invisible Background of Industrial Progress

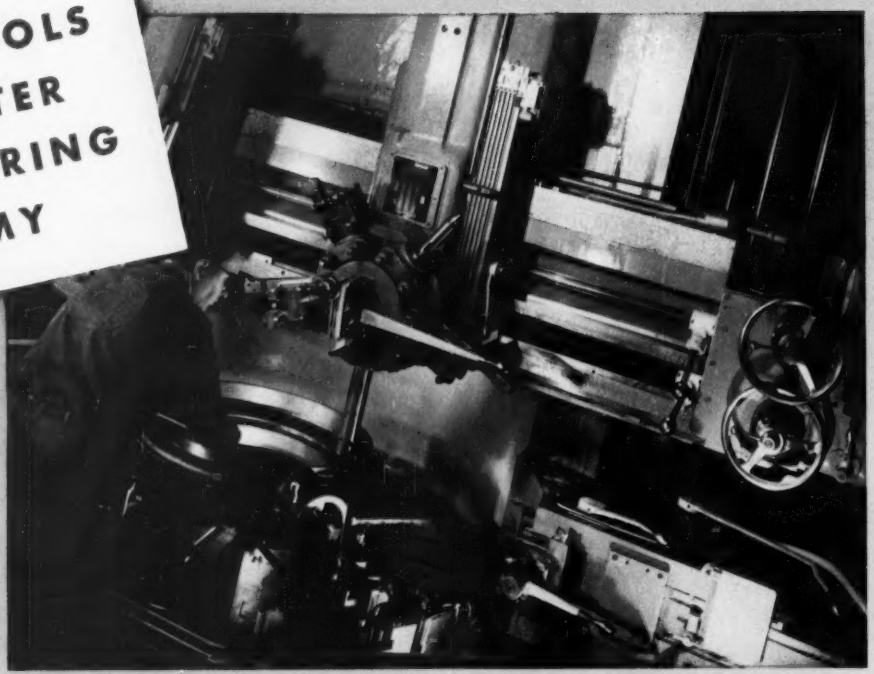
Farsighted Industrial America is forging its maritime links with all parts of the world. For security and peacetime commerce, fast ships are more essential now than ever in our history. Free enterprise and initiative promote the development and construction of such engineering feats as the S. S. *United States*. Nine hundred and ninety feet in length, she is the largest American ship ever built. From her tremendous turbines and pumps down to lifeboat launching equipment and portholes, the equipment represents "The Invisible Background of Industrial Progress." ★ *Modern Machine Tools,* the basic means of machining interchangeable parts, make possible the fulfillment of such engineering enterprises.

Bullard is indeed proud that many of the parts for the S. S. *United States* were machined on their equipment and that they have made their niche in American progress.

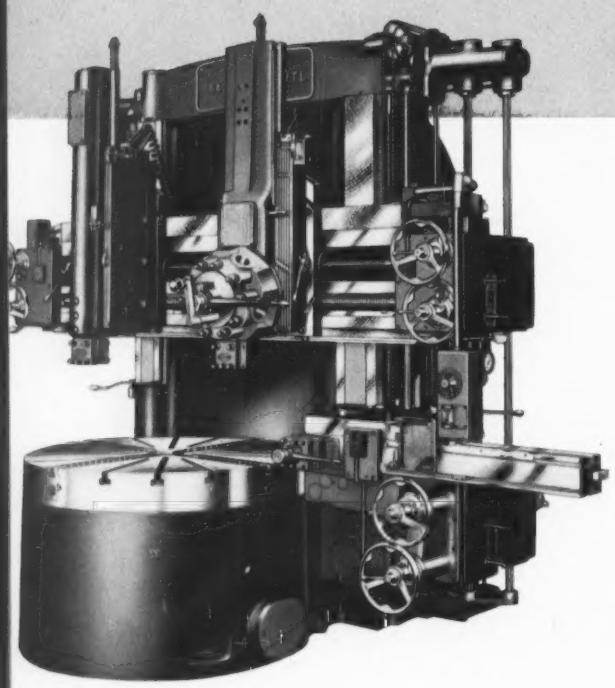
★ *For greater manufacturing economy REFER to next page.*

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



The Bullard Cut Master Vertical Turret Lathes, built in six sizes 30-36-42-54-64 and 74″ with various head combinations, offer rigidity, accuracy, metal removing ability and convenience of operation, assuring profitable production on single piece jobs or on the long runs.



Manufacturing industries the world over know the versatility, accuracy and efficiency of Bullard Machine Tools. Among these are many who contributed to the building of the most modern ship *United States.*

We proudly claim our part in this outstanding maritime project through manufacturers using Bullard machines in the production of pumps, compressors, valves, electric motors, turbines, shafts, gears for speed reducers, parts for winches and davits as well as the machining of every porthole frame.

Such broad acknowledgement of the use of Bullard machines bespeaks not only confidence in productive ability but an assurance of sound investment in manufacturing equipment.

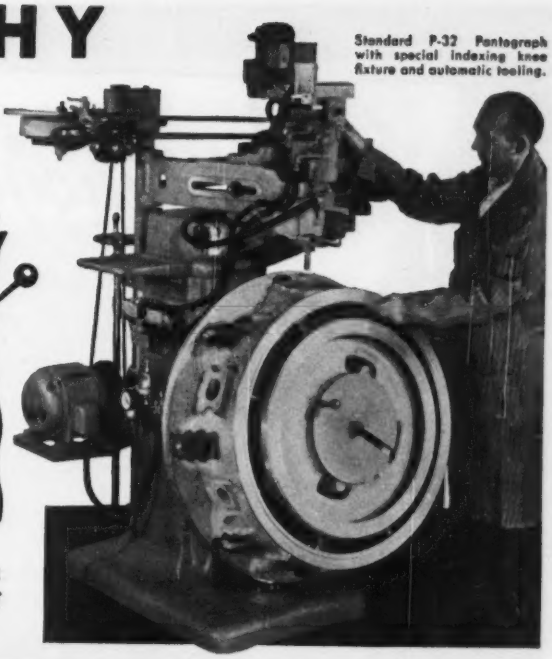
BULLARD

Time saved is money earned. Write now for information on the six sizes of Cut Master Vertical Turret Lathes.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

PANTOGRAPHY

Solves Complex Profiling Problems with Automatic Cutting Cycle

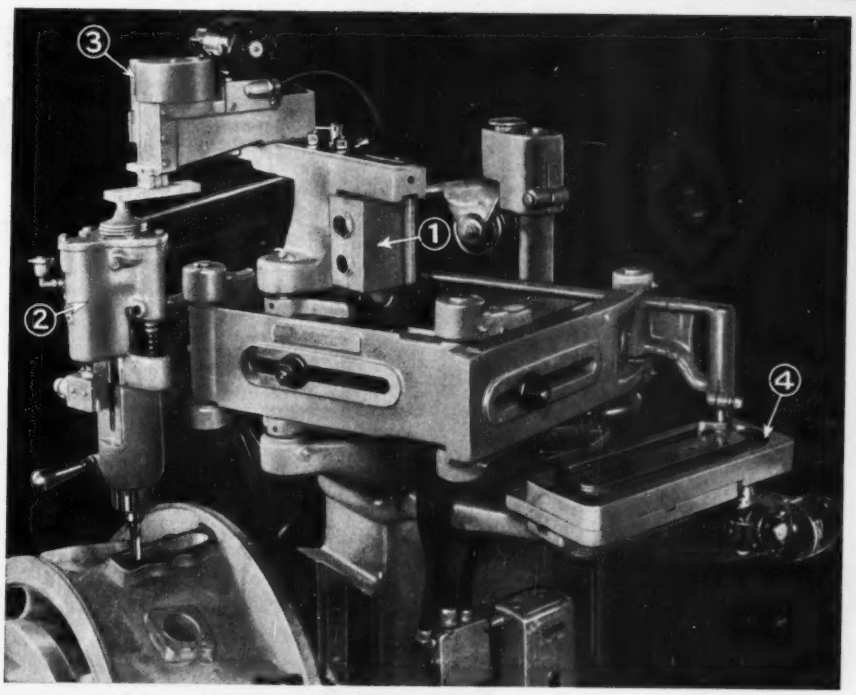


Standard P-32 Pantograph with special indexing knee fixture and automatic tooling.

PROBLEM: Profiling eight ports in outside portion of aircraft part, a large aluminum-alloy casting. The sides of each port are parallel; one end has a true radius, the other end is parabolic.

SOLUTION: Gorton P-32 Pantograph profiles all eight ports at the rate of 2.3 minutes per port. Cutting cycle is automatic; indexing is manual.

This is truly a power-driven tracer-control job that would require hours if done by a combination of other methods.



Here's How It Works

❶ Complete cutting cycle begins when "start" button is pressed.

❷ Air cylinder automatically feeds cutter down to cutting position. Cam-operated spindle down feed then takes over. Upon completion of cut and after spindle retracts, this air cylinder further retracts cutter for clearance.

❸ Speed of spindle down feed during cutting is controlled by cam through a Variac.

❹ Motorized chain-driven master starts automatically when "start" button is pressed.

This is just one of many Gorton tracer-controlled production short-cuts which might save you time and money. For complete information, clip and mail the coupon now.

GEORGE GORTON MACHINE CO.

1307 Racine St., Racine, Wis., U. S. A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-1307

Firm .....

Name .....

Title .....

Address .....

City, State .....

Announcing NEW PINES

Patents Pending

SPECIFICATIONS

CAPACITY

Hydraulic Power — 20 tons.

Tube Size Range — ½" through 2" O.D. Maximum 2" x .083 steel tubing.

Bending Clearance — 2" tube with 5" center-line radius to 180°.

CUSHIONS

Twin double-acting cylinders offset mounted on sides of press, direct connected to heavy, needle bearing crank arms of wing die holders. Three anchor positions compensate for various settings.

DIE HOLDERS

Forward-mounted, equally controlled wing-type with single screw adjustment and die recesses.

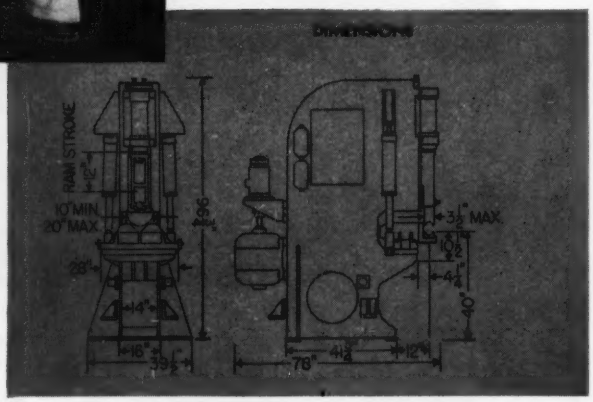
BASE

Welded HR steel frame work, stress relieved. Incorporates oil reservoir, pump, motor, and valve-mounting units.

ELECTRICAL

20 hp, 1200 rpm motor powers 2000 psi Vickers pump. 220-440 volt, 3-phase, 60-cylce. Control circuits on 110 volt through transformer.

New Pines 20-Ton Vertical Hydraulic Tube and Pipe Bending Press showing side-mounted twin oil coolers, panel-mounted hydraulic valves, side offset-mounted cushion, and 10-station automatic angle-of-bend selector turret. Note how design eliminating under die cushion mounting provides extra working clearance. On this setup, adjustable bars at left are used for positioning workpiece for various planes of bends.



PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

686 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

20-Ton Tube and Pipe BENDING PRESS

DESIGNED WITH EXTRA WORKING CLEARANCE..... SPEEDS HANDLING BROAD RANGE OF MULTIPLE BENDS IN ONE SETUP

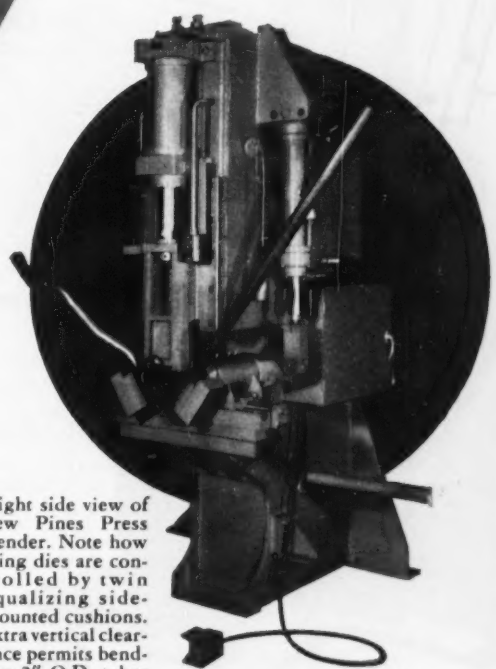
You'll find in the new Pines 20-Ton Hydraulic Press Bender a world of new production features, including those you have been wanting for a long time, that will help you substantially increase output and reduce production costs. You'll find the overall design affords greater working area on both sides and in front of the press and permits handling a much broader range of multiple bends in a single setup.

You'll like the new 10-station automatic angle-of-bend selector that eliminates cycling through idle stations, and the twin double-acting cushion cylinders on each side of the press that positively maintain a constant equalized pressure and help produce smoother, better bends without excessive flattening or distortion. Easy operating and setup features are included that save time and reduce operator fatigue.

These, and the many other outstanding Pines features listed below, will help you step up efficiency as much as 50% in handling, for example, automotive exhaust and tail pipes requiring a variety of bends in different planes, as well as the hundreds of other jobs adaptable to press benders.

OUTSTANDING FEATURES

- **Twin Equalizing Side-Mounted Cushions** — eliminate base obstructions, provide greater working clearance, maintain constant torque, reduce flattening and distortion.
- **Faster Cycling** — 10-station angle-of-bend selector indexes and resets automatically to starting position, eliminates cycling through idle stations, increases output.
- **Greater Work Handling Capacity** — extra clearance reduces number of setups on multiple bending, permits broader use of uniform radii, cuts tooling and production costs.
- **Interchangeable Pick-Off Turret** — for angle-of-bend control. Permits storing and remounting for repetitive jobs, reduces setup time, insures accurate duplication on repeat work.
- **Adjustable Ram Speed Control** — assures efficient operation, simplifies setups. Ram can be lowered slowly or stopped at any point.
- **Built-In Oil Coolers** — maintain uniform oil viscosity, assures uniform results on production runs.
- **Single-Screw Wing Die Adjustment** — eliminates problem of equalizing die settings. Adjusts both die holders simultaneously.
- **Movable Foot Control** — assures maximum convenience, reduces operator fatigue. Master safety switch on ram slide.
- **Sturdy Welded Steel Frame** — stress relieved, assures rigid die support, provides extra working clearance.
- **Compactness Conserves Floor Space** — 100-gal. oil reservoir in base, motor vertically-mounted at rear, panel-mounted valves.

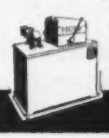


Right side view of new Pines Press Bender. Note how wing dies are controlled by twin equalizing side-mounted cushions. Extra vertical clearance permits bending 2" O.D. tubes on a 5" center-line radius to 180°.

PROMPT DELIVERY — Write today for more data and prices on the new Pines High Production Bending Press. They are being lot-produced as standard units and prompt delivery can be made on early orders. They are designed and built by America's leading manufacturer of tube bending equipment.

Automatic Benders

Semi-Automatic Benders



Tube and Rod End-Finishing Machines

Bench-Type End-Finishing Machines

The Forger
ARTICLE 6
MULTIPLE OPERATION FORGINGS HAVING DEEP HOLES THAT DO NOT EXTEND THROUGH THE ENTIRE FORGING
MULTIPLE OPERATION SOCKET WRENCH DIES
SKETCH "A"
MULTIPLE OPERATION FOR DEEP PIERCED FORGING
PROGRESSIVE PIERCING METHOD
SKETCH "B"

aids TO MODERN FORGING PRACTICE

YOU ARE INVITED to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods. We will be glad to send a complete set of all eleven issues of "The Forger" in addition to placing your name on our mailing list to receive future issues as they are prepared. There is absolutely no charge for this service. We are glad to make this gesture towards the advancement of modern forging practice as executed on ACME XN Forging Machines.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1203 W. 65th St., Cleveland 2, Ohio**

ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

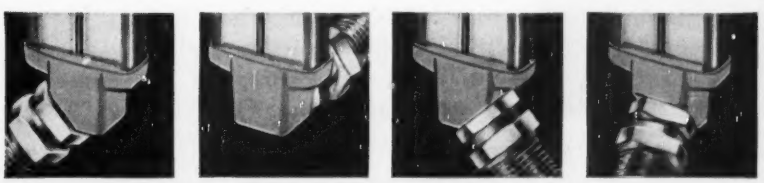
Bronze Extrusion makes a stronger sales case for this industrial glass thermometer

The case for this "American" Industrial Glass Thermometer made by Manning, Maxwell & Moore, Incorporated, Stratford, Conn., used to be a steel stamping. Now it's made of ANACONDA Extruded Bronze.

Why the change? Because this extruded bronze shape makes a far stronger and more rigid case; it's easier to produce; it simplifies assembly—and adds additional quality to an already high-quality product. So accurate are these bronze extrusions that neither straightening nor machining is needed for assembly. And assembly time itself is cut.

For the base, an ANACONDA Brass Die Pressed Forging is joined to the case by brazing to provide greater joint strength. By machining the appropriate face of a single-style base forging, a stem connection can be provided at any angle.

ANACONDA Brass and Bronze have long been making a stronger "case" for products—by simplifying production; by the higher quality that is always associated with products made of brass or bronze; by increasing sales appeal. We urge you to consider the advantages of these metals for your manufacturing processes and your products. For information, write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. E387

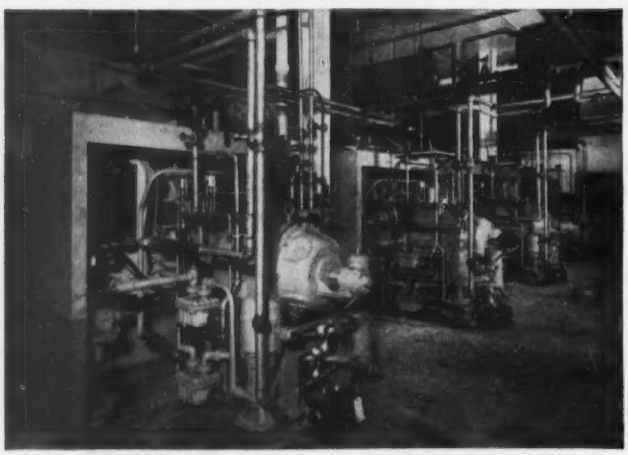


Base forging can be machined to provide stem connection at any angle and direction.

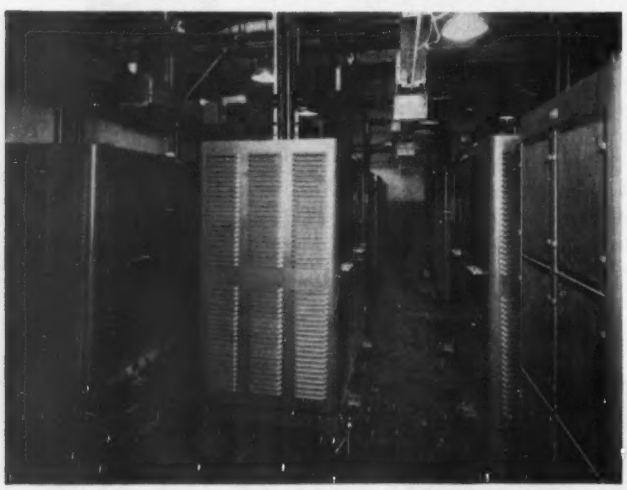
Extruded case and forged base for this 9-in. "American" Thermometer are joined in perfect alignment by brazing. No machining or straightening is required.

ANACONDA® —the name to remember in **COPPER—BRASS—BRONZE**

Obtaining flight data from the test stands. Note convenient Reliance V★S Drive controls to the right of each operator.



Adjustable-speed drive motor for each of the 25 stands is a 75-horsepower explosion-proof Reliance Heavy Duty Type 'T'.



Reliance V★S Drive control units can be placed at any convenient location. Here they have been put in a separate room.

25 JET TEST STANDS

powered by RELIANCE V★S DRIVES simulate engine flight conditions at 50,000 feet . . . .

Using 25 specially designed test stands, the Holley Carburetor Company tests fuel-flow governors under conditions similar to those they will encounter in jet engines splitting the air from sea level to 50,000 feet up. Through grueling test periods, generally in excess of 24 hours, these test stands ask a lot of their drives.

The Reliance V★S Adjustable-speed Drive . . .

1. Supplies the needed driving power despite tremendous loads caused by simulating ram and flight conditions.
2. Guarantees speed regulation of one-half of 1%—or better—within half a second.
3. Provides convenient, easy-to-operate controls.

A Reliance Electronic Regulator coordinated with each drive provides the precise speed regulation required for the success of the test. As the governor takes over regulation of the speed, the electronic regulator performs the vital function of preventing any over-run of speed as the load decreases.

The outstanding job being done on these test stands offers one more example of the versatility and flexibility of Reliance V★S Drive. For more detailed information about Reliance V★S, the original packaged all-electric adjustable-speed drive for a-c. circuits, write for Bulletin D-2311. D-1445

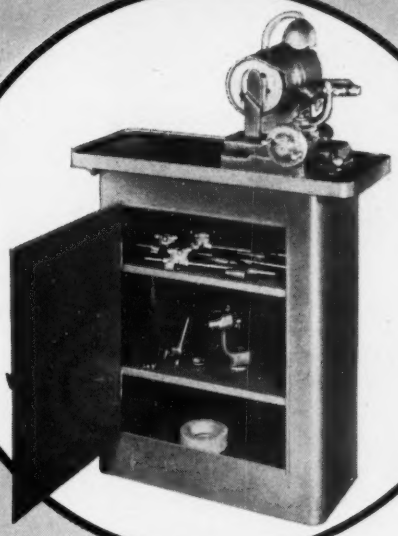
Sales Representatives in Principal Cities

RELIANCE V★S DRIVE

RELIANCE ELECTRIC AND ENGINEERING CO.

1077 IVANHOE ROAD, CLEVELAND 10, OHIO

Get more than twice the usual life from your drills



CABINET-PEDESTAL
Available for mounting the No. 1-G Drill Grinder. Made from steel with wooden shelves. 31" high from floor. 13" x 30" top.

Eight times more holes per grind

Over 90% saving in drill cost

Gives even the smallest drill a production point that pays a profit

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- BORING, DRILLING AND MILLING MACHINES
- DRILL AND TOOL GRINDERS
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

SELLERS NO. 1-G DRILL GRINDER

WITH BALL BEARING SLIDE

This small, self-contained, bench-type grinder embodies the sound features that have conclusively demonstrated their superiority in the larger Sellers Drill Grinders. Foremost among which are the basic principles and inherent accuracy of the Sellers Chuck and the Sellers advanced method of drill grinding. This grinder produces the Sellers point on a single drill or an exact duplication on as many drills as are required. It grinds right hand 2 lip twist drills from .028" (No. 70) up to ½" diameter to any included angle of point from 80° to 160°. Designed with ball bearing slide, ball bearing swing frame and quick-adjusting tail center which combined provide increased accuracy, reduced wear and further simplification of operation and adjustment. Sellers Drill Grinders are built to last. Part replacements are negligible, however, if required, replacement parts are always available. Complete information will be furnished upon request.

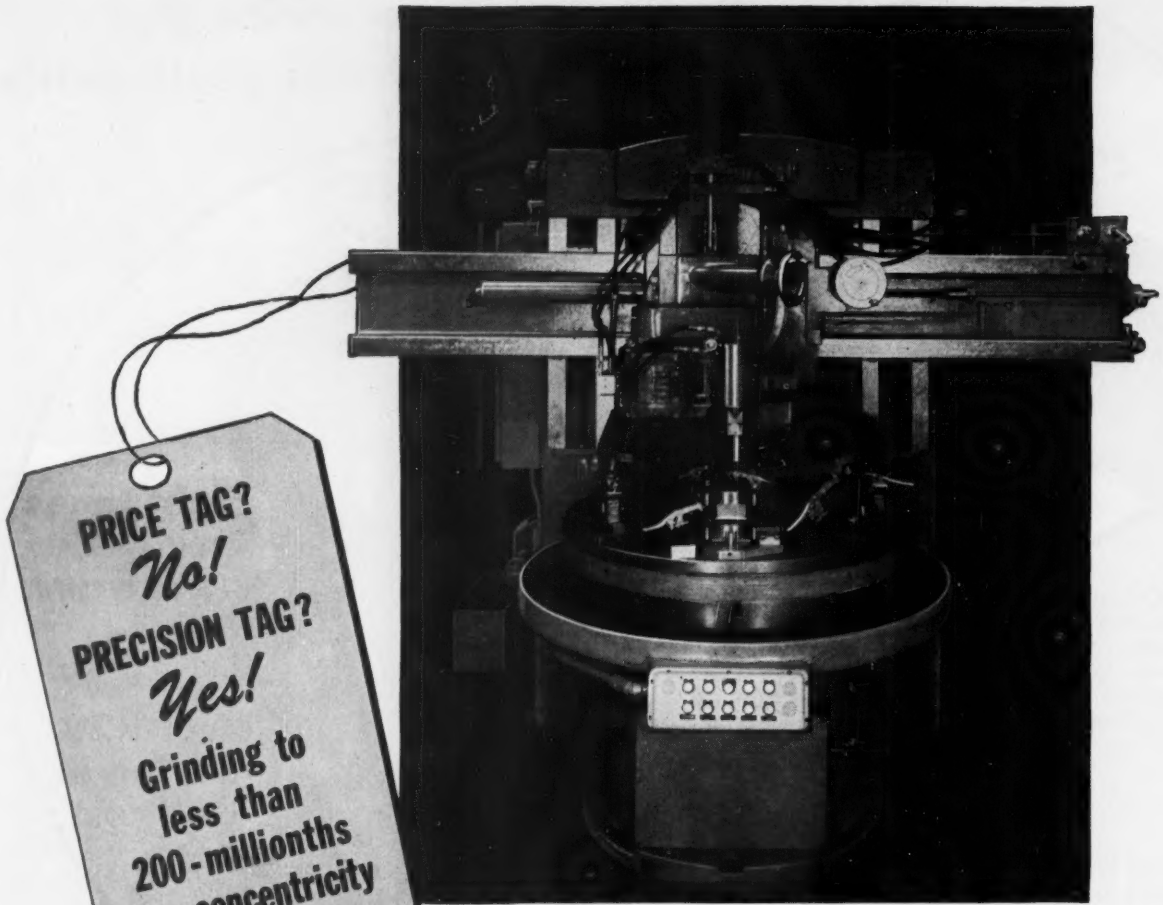
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED



Single spindle 1800 Series Frauenthal Grinder, specially engineered for grinding Diesel engine connecting rods . . . typical of numerous operations where the workpiece is large and cumbersome but hole to be ground is relatively small.

. . . another "MILLIONTHS-of-an-inch" Frauenthal Grinder

IT'S the extreme precision to which Frauenthal Grinders work that surprises metalworking leaders who know the potentials of modern speed-and-precision machines. You will be surprised, too, at the savings in time and money you can make with these super-precision grinders!

In both toolroom and production set-ups, simultaneous grinding of inside or outside and faces . . . or boring and turning . . . can now be held to such close precision of parallelism and concentricity that measurements of tolerance get down to *fractions-of-ten-thousandths,* best expressed in *millionths* of an inch!

Manufacturers of precision parts for aircraft, jet and automotive engines, tanks, gunmounts, radar units, Diesel connecting rods, plug valves, high precision bearings and other industrial and military parts and assemblies find Frauenthal Grinders profitable investments. You are sure of utmost precision, unfailing interchangeability and speedy, dependable production with these "millionths-of-an-inch" grinders.

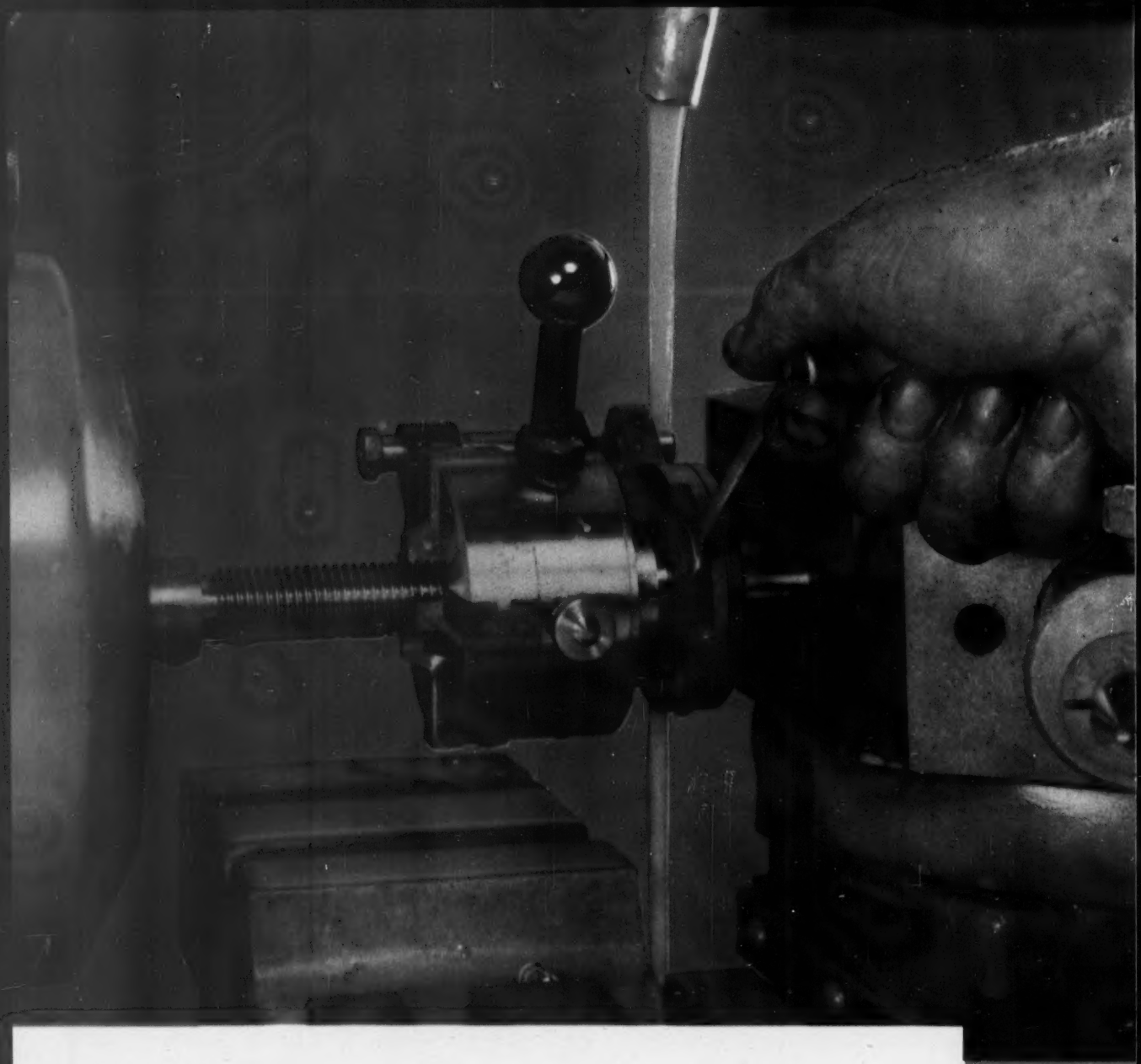
Series 1800 available in 4 standard sizes, with 30", 36", 42", or 48" tables and 60" maximum swing. Specially engineered features can be included to fit your requirements.

Frauenthal
MULTIPLE-HEAD SUPER-PRECISION CYLINDRICAL **Grinders**
PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY TO MILLIONTHS OF AN INCH

write for bulletin

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

SCENE 114:
"3 Taps in 1"
...an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "Sometimes a very special tap is the only solution to a difficult threading problem . . . Here we see a special tandem tap designed by GTD-Greenfield engineers to enable a pump manufacturer to tap three concentric holes in one operation . . . Special taps may far offset higher initial cost in greater production on the job."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.



MISALIGNMENT EASILY CORRECTED

Misalignment is a serious matter in threading and should be rectified as soon as possible. With the GEOMETRIC DS Head, however, uninterrupted production may be maintained on slightly misaligned jobs until permanent adjustment can be conveniently made.

By loosening two "back screws" on the ALIGNING SHANK, the head is allowed to float. A true-running work blank may then be threaded and the head, thus aligned, retightened with the "back screws."

Write for full details. Specify Bulletin DS

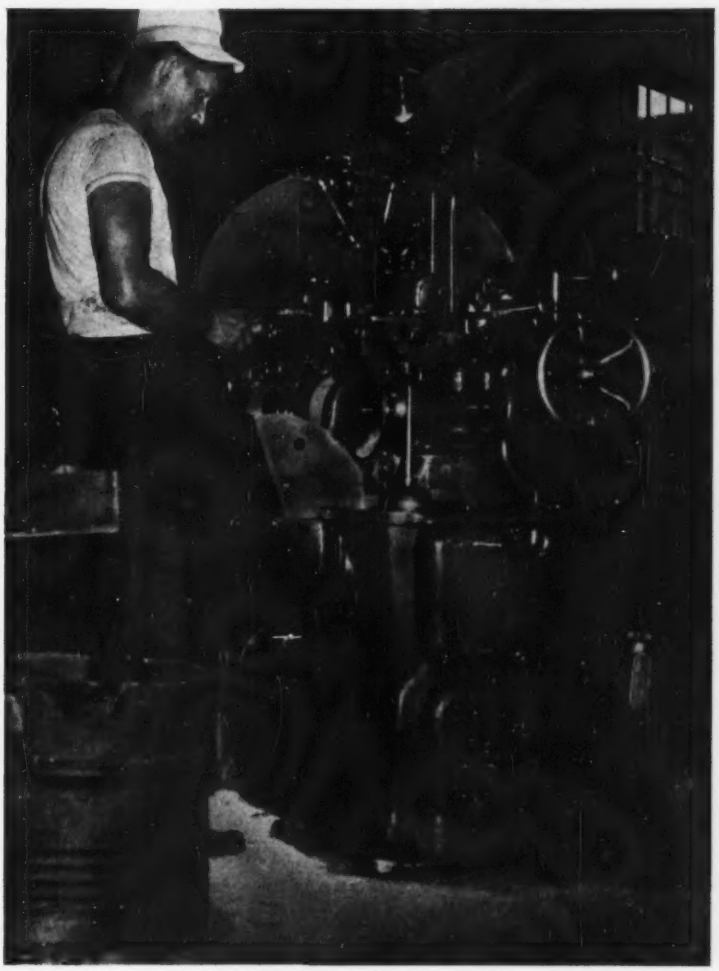
Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

NEW HAVEN 15, CONNECTICUT

GEO MET RIC

"SINCLAIR Cutting Oils Increased Tool Life 33%"



"The Highland Machine and Screw Products Co. (Highland, Illinois) specializes in automatic screw machine work...

...therefore quality lubricants are a MUST for our equipment," states President C. J. Zimmermann.

By experience, Mr. Zimmermann has found that "Sinclair WILKUT 'A' not only increased tool life on our Brown & Sharpe Automatics by approximately ⅓, but it also improved the finish for the machining of non-ferrous metals and free machining cold rolled steel. In addition, because of the non-corrosive action of WILKUT 'A', both ferrous and non-ferrous metals can be run on the *same machine*.

"We also find Sinclair UMBRA® Cutting Oil a 'natural' for threading and machining of the more critical steels. We *are convinced* that the performance of Sinclair lubricants has minimized maintenance and operating costs in our plant."

Invite a Sinclair Lubrication Engineer to consult with your Maintenance Superintendent by calling your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR CUTTING OILS and COOLANTS for Metal Cutting

(WILKUT—Reg. U. S. Pat. Off.)

MAKE YOUR TOUGH PRESSING PROBLEMS SAY "UNCLE"

WITH A KRW HYDRAULIC PRESS!

Here are a few "case histories" of KRW Hydraulic Press performance in metalworking plants. There are hundreds more in the files of our Sales Department, proving that a KRW Hydraulic Press cuts costs, saves time and labor, and improves quality in your type of work. Available in one, two and three cylinder models, hand, air or motor driven; 25-150 tons. If you need a special Press we'll build it for you.

Look over the jobs KRW is doing for other companies. Chances are, you have a pressing problem similar to one of these. And KRW can help you solve it. Write, wire or phone for complete specifications and prices. Dep't. 15.

PRODUCTION Phinney Tool & Die Co. bought this press to test large dies which they were making for a manufacturer of tank parts. Later it developed that the manufacturer didn't have proper equipment to put the dies into production. So the dies were sent back to Phinney with instructions to produce the tank parts on the same press that had tested the dies. As a result, this KRW Hydraulic Press has since produced thousands of tank parts in addition to its regular work of testing dies.

STRAIGHTENING AND RESIZING Setting rivets, driving home T-handles to prevent loosening, straightening C-Clamps that bent as they cooled, resizing distorted plungers, straightening distorted cams and feet on eccentric clamps — these are just a few of the trouble-shooting jobs this KRW Hydraulic press does for Batavia Clamp Co. You too can do straightening work faster, at less cost, with this type of KRW motor-driven Hydraulic Press.

DIE TRY OUT Versatility counts high on this job. Whether die making itself is your business or whether you're testing dies for use in your own production, a KRW Hydraulic Press will soon pay for itself in time and money saved. With a KRW Press, you *know* dies will work in production. Converts in minutes from one setup to another and gives you the extreme accuracy needed in die testing.

BENDING Here's versatility with a capital KRW! This press was originally purchased to do one job and is now performing 15 different operations for a manufacturer of dry cleaning equipment. The customer voluntarily told us: "We bought this press late in 1950 and it's paid for itself ten times over."

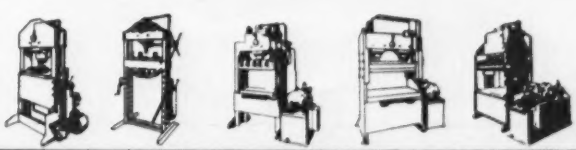
You can't lick this stamp!
. . . It was done on a KRW Hydraulic Press . . . famous for doing all kinds of stamping work faster, better, at less cost!
K·R·WILSON
Designers and builders of Hydraulic Presses to meet any metal-working problem

STAMPING serial numbers on water meter lids was a problem for this company. It was being done on a hand press *after* the hinged lid was attached to the meter housing. Result: Bad register or "sprung" lids due to variations in pressure. A 25-ton KRW motor-driven Hydraulic Press solved the problem. Each stroke of the KRW Press produces the same amount of pressure. There are no more "sprung" lids; each number is in perfect register, and production is 4 times greater!

DEEP DRAWING & FORMING KRW Hydraulic Presses are especially suited to deep-drawing work because they produce maximum pressure at any part of the stroke. Ram can be eased down to the work and stroke can be adjusted to handle several different drawing jobs. You get greater accuracy, minimum rejects, faster production.

K·R·WILSON

215 MAIN ST., BUFFALO 3, N. Y.



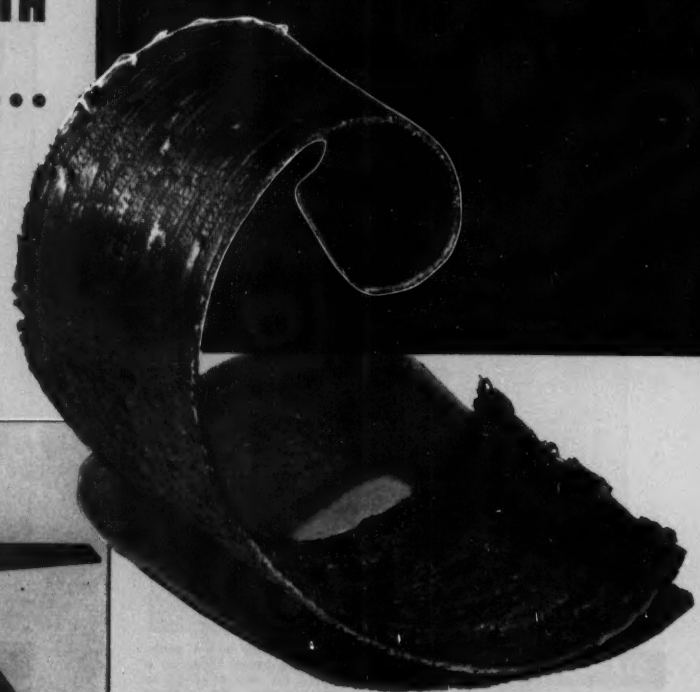
Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

50 lbs. oil pressure

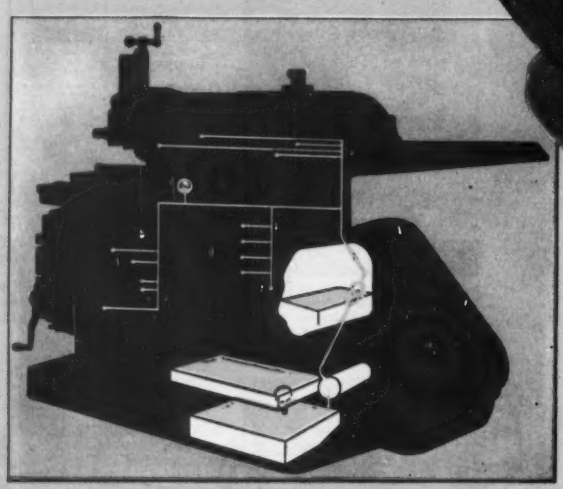
IS NECESSARY WITH A CUT LIKE THIS...

This tremendous cut demonstrates the extra strength, rigidity, and power in Cincinnati Shapers. It also demonstrates the ability of the 50 p.s.i. lubrication system to develop and maintain oil films under the heaviest loads.

Write for Catalog N-5.



Demonstration cut.
Actual size steel chip, 2" cut .030" feed Cincinnati 24" H.D. Shaper.



50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.

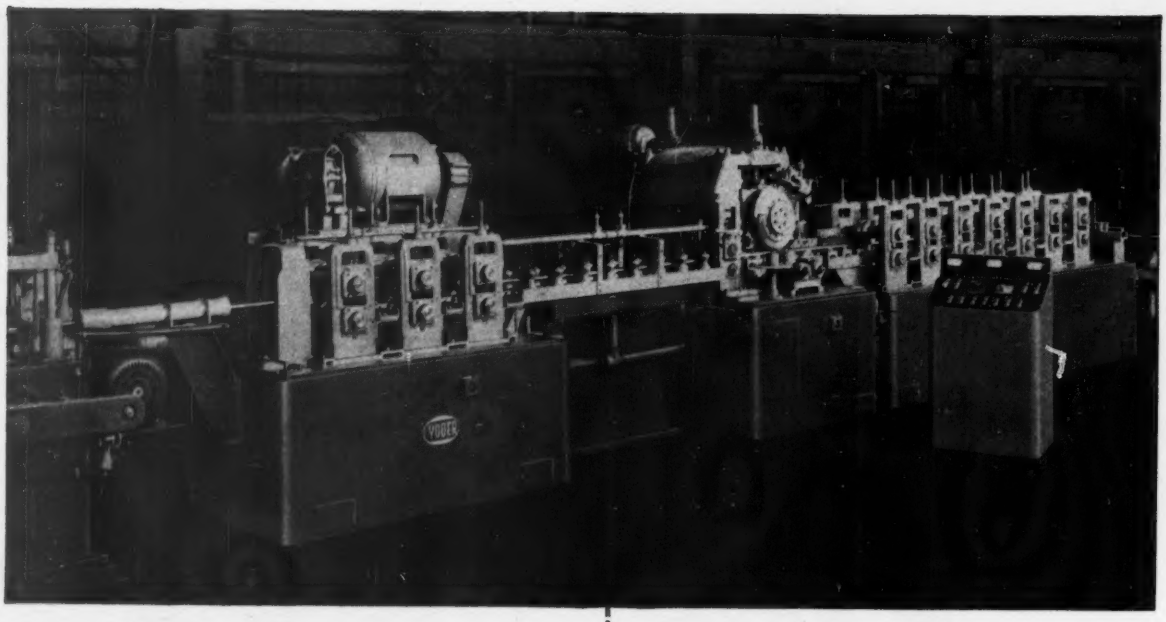
The Electro-Magnetic Brake and Clutch, with finger tip control, is a Cincinnati feature for speed and ease of operation.

THE CINCINNATI SHAPER CO.

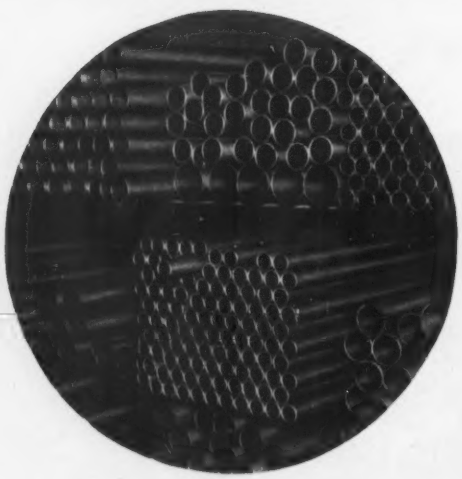
CINCINNATI 25, OHIO, U.S.A.

SHAPERS • SHEARS • BRAKES

CINCINNATI



Highest Output of



Quality Tubes

• Most manufacturers, when investing in an electric-weld tube mill, do so only after careful investigation, especially of performance records. Where, as often happens, records are available of the output and scrap losses of different mills, making comparisons possible, the choice of a Yoder is never in doubt. As a result, since their introduction in 1938, more Yoder mills have been installed in the U.S.A. and many foreign countries than electric-weld mills of all other makes combined.

In fact, the high quality and economy of tubing made in Yoder mills, have powerfully stimulated consumption and multiplied the uses for electric-weld tubing in the automotive, electric appliance, metal furniture and other mass production industries. The supply of such tubing, therefore, has never caught up with the demand.

Get the facts about Yoder mills, incorporating the latest developments in tube making, including the revolutionary new Yoder high speed induction welders for *non-ferrous as well as ferrous metals* and alloys.

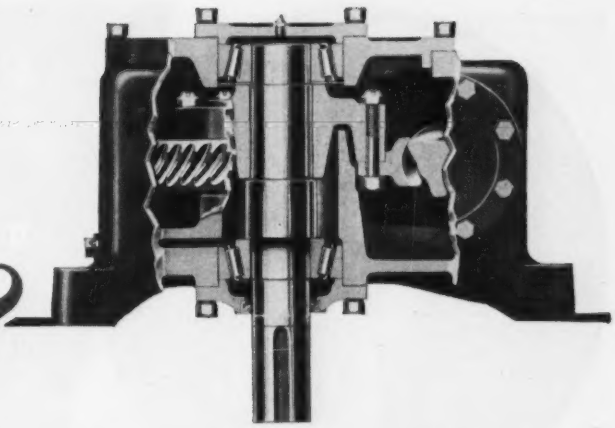
THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

THE RIGHT DRIVE



...where Dependable Performance Counts

RIGHT

. . . because they are designed and built to insure efficient and reliable power transmission even under the most severe operating conditions.

Philadelphia WORM GEAR SPEED REDUCERS

are of extremely sturdy construction throughout. Bearings have a generous spread, which in the vertical units as shown here, provide for heavy radial loads. Note, too, the famous dry-well construction which eliminates oil leaks down the vertical shaft, and these are but a few of the outstanding features found in Philadelphia units.

Vertical type reducers can be furnished with output shafts extended either up or down. Conventional horizontal types can also be supplied. A complete range of ratios from 3½:1 up to 6300:1, in units up to 250 horsepower, provide complete selectivity.

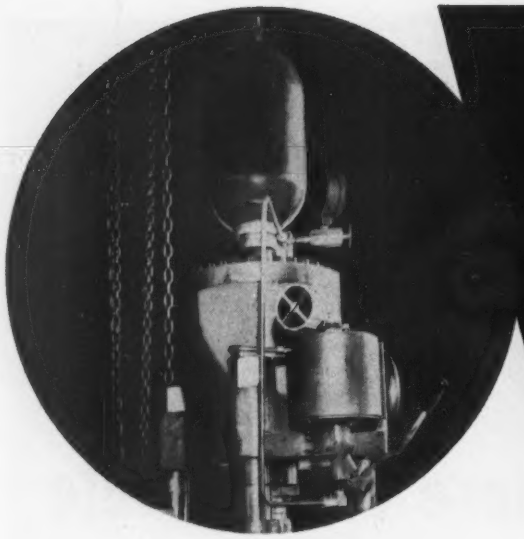
For full information on Philadelphia Worm Gear Speed Reducers, write for catalog WG-51.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK · PITTSBURGH · CHICAGO · HOUSTON · LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



A Large Tungsten Carbide Manufacturer Licked a Problem by "Slugging" With a BALDWIN Compacting Press

The Problem:

A large manufacturer of Tungsten Carbide wanted to compress a very fine 100 mesh Tungsten Carbide powder into a slug which was needed for the next production step. It was particularly difficult to obtain slugs of a uniform density.

The Baldwin Solution:

A Model 20 Baldwin compacting press with a "floating head" is producing the Tungsten Carbide slugs of constant density. Although the size of the slugs varies, the pressure applied to the fill by the ram is controlled accurately hydraulically.

The "floating head" does the trick . . . an accumulator mounted on a specially designed head controls the amount of pressure developed . . . when the ram tends to exceed this pressure, the head "floats" against the hydraulic cushion.

Baldwin Model 20 Compacting Press with "Floating Head" for pressures up to 75 tons. Model 45 (up to 200 tons) also available with "Floating Head."

What's Your Pressing Problem?

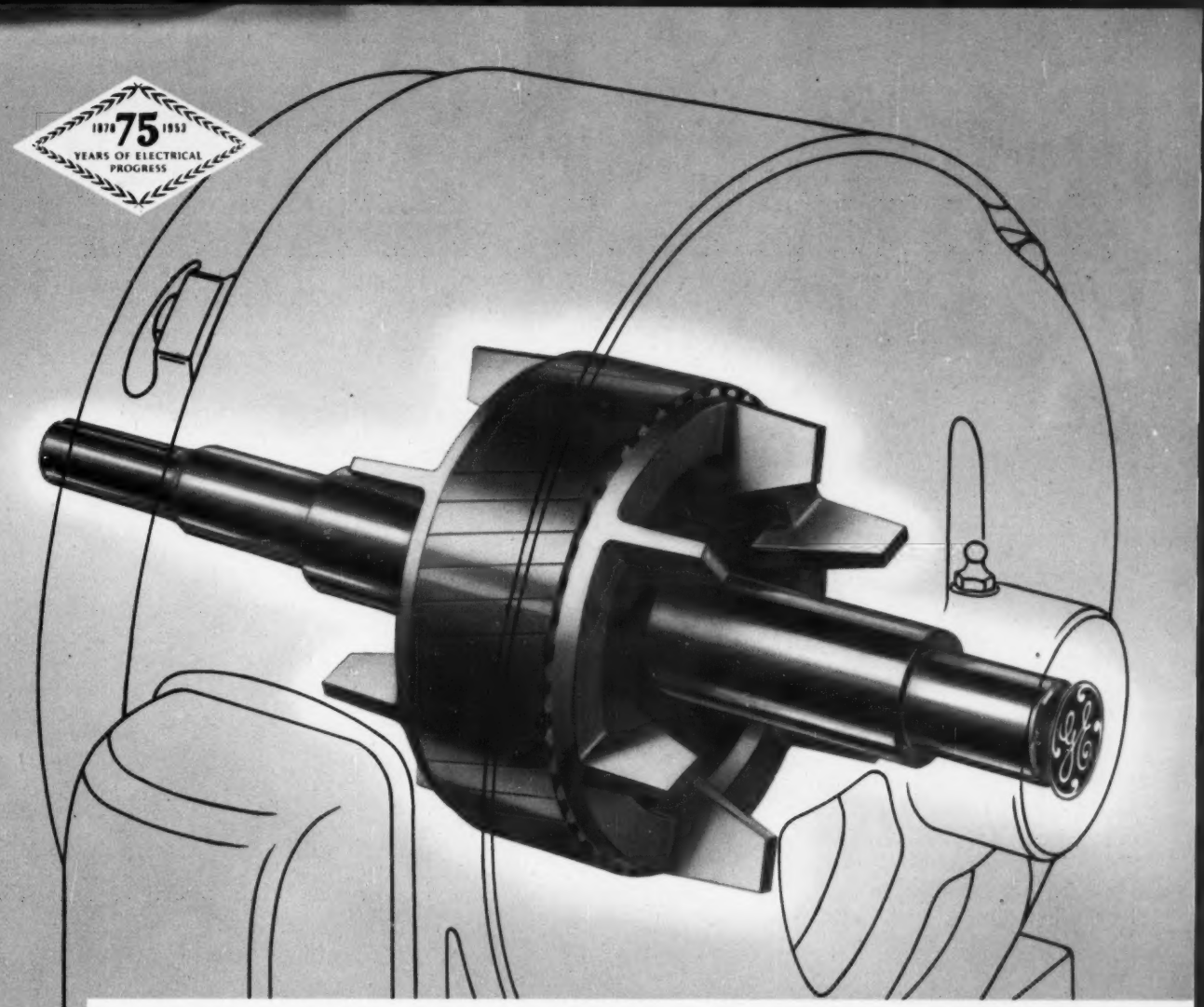
You, too, can rely on Baldwin's press engineering department to help you solve any of your compacting problems . . . pressing of powdered metal parts . . . preforming of plastics . . . pressing of ceramic parts. Write to Dept. 3819, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

1878 75 1953
YEARS OF ELECTRICAL PROGRESS



Why rotors don't fail in G-E TRI CLAD motors

REG. U.S. PAT. OFF.

G-E pioneering and research developed and produced this one piece cast-aluminum rotor winding, which has virtually eliminated rotor failures in Tri-Clad motors.

Rotor is indestructible in service because the bars, end rings, and fans are a "one-piece" casting. No brazed joints, no fabricated fans to come apart.

Rotor inertia is reduced by the lightness of the aluminum, thus raising efficiency and allowing easier starting, stopping and reversing.

Rotor efficiency is higher, operating losses reduced, as the result of a special chemical treatment.

The motor runs cooler because the integrally cast fans dissipate heat faster.

Operation is smooth and quiet due to the dynamic balancing of the rotor which also reduces bearing wear and material fatigue.

Long rotor life is one more reason why G-E Tri-Clad motors last longer — give you more reliable service and greater operating economy.

Order Tri-Clad motors today from your nearby G-E representative. You'll find popular models in stock. General Electric Co., Schenectady 5, N. Y.

752-20

You can put your confidence in—

GENERAL ELECTRIC

DIALIZE and ECONOMIZE

Any AGD Adjustable Limit Snap Gage becomes a DIAL INDICATOR Snap Gage with a STANDARD *Dializer*

Patented

Simplicity Itself!...

By removing a pair of pins from the snap gage and inserting a STANDARD Dializer any make of AGD Snap Gage in any model, A, B or C, is instantly converted to a DIAL Snap Gage. Dializer is easily transferred from one frame to another.

Dializers are available for complete range of AGD Adjustable Limit Snap Gages (MODELS A, B or C)

No. 1 fits AGD Frames 1 thru 6
No. 2 fits AGD Frames 7 thru 10
No. 3 fits AGD Frames 11 thru 16

No. 3 Dializers also fit larger size frames beyond AGD size range (available from STANDARD) for dimensions up through 26⅝".

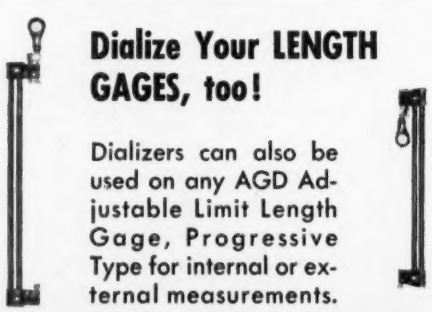
ACCURACY ASSURED by double reed principle.

RANGE OF ADJUSTMENT of gage is unaffected.

INDICATOR either with .0001" graduations and .005" range, or with .001" graduations and .025" range.

We can supply snap gage frames if you do not already have them. Tungsten carbide contact points, anvil blocks and snap gage pins are also available.

Write Today for Your Copy of Catalog C



Dialize Your LENGTH GAGES, too!

Dializers can also be used on any AGD Adjustable Limit Length Gage, Progressive Type for internal or external measurements.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

Modern Manufacturing Needs Modern Replacement Programs

"The MAPI plan serves as a guide to equipment replacement and manufacturing technique improvement in all plants of the Shakeproof Division.

"When our plant on St. Charles Road, Elgin, Illinois, was completed in 1949, it was acknowledged as the most modern screw manufacturing plant in the world. Considerable automatic equipment and a mile-long conveyor system are utilized for maximum production efficiency with manual effort reduced to a minimum.

"It was logical that planned machine replacement, guided by MAPI principles, be utilized in the operation of this modern plant. It is further logical that a business based on improving methods, increasing quality and lowering the production costs of its customers should apply these same principles to its own operations."

EUGENE W. FULLER
Vice President and Division Manager

SHAKEPROOF DIVISION
ILLINOIS TOOL WORKS

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

July, 1953

BROACH FOUR SURFACES
OF SLEEVE YOKE EARS

ONE MACHINE

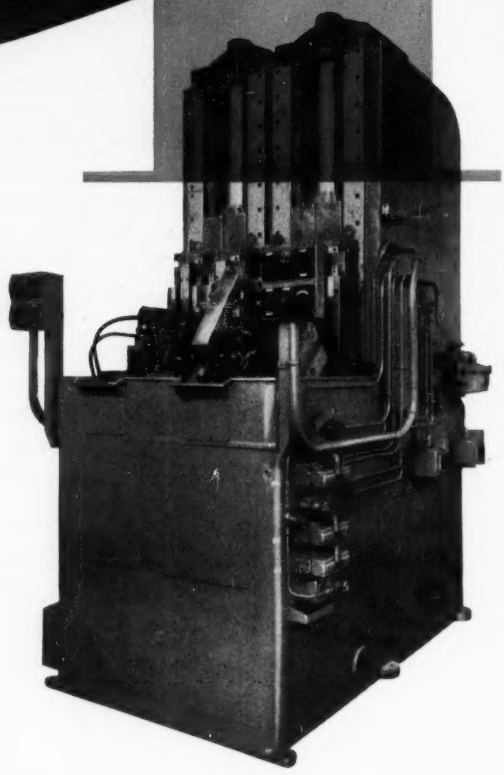
with interchangeable locators broaches 3 similar parts at 500 per hour

THE *American* WAY

Two, two-station base fixtures, mounted on tilting work tables, and arranged with automatic clamping, permit finish broaching the outside and inside faces of the ears on the sleeve yoke parts illustrated . . . at the rate of 500 parts per hour. Interchangeable locators makes it possible to broach any one of three similar parts on this American SBD-48-25 dual ram suface broaching machine.

The savings in time and the resulting low cost per unit are obvious. Such results, however, are typical when American engineers apply the knowledge and experience accumulated during the past 27 years to the practical solution of broaching problems.

Write, sending sample part or detail drawing and mention your hourly requirements. Our Engineering Department will be glad to furnish recommendations for the right machine and the proper tooling. And remember, American manufactures all three . . . broaches, machines and fixtures to give you a properly engineered, balanced solution to your metal removing problems.



AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

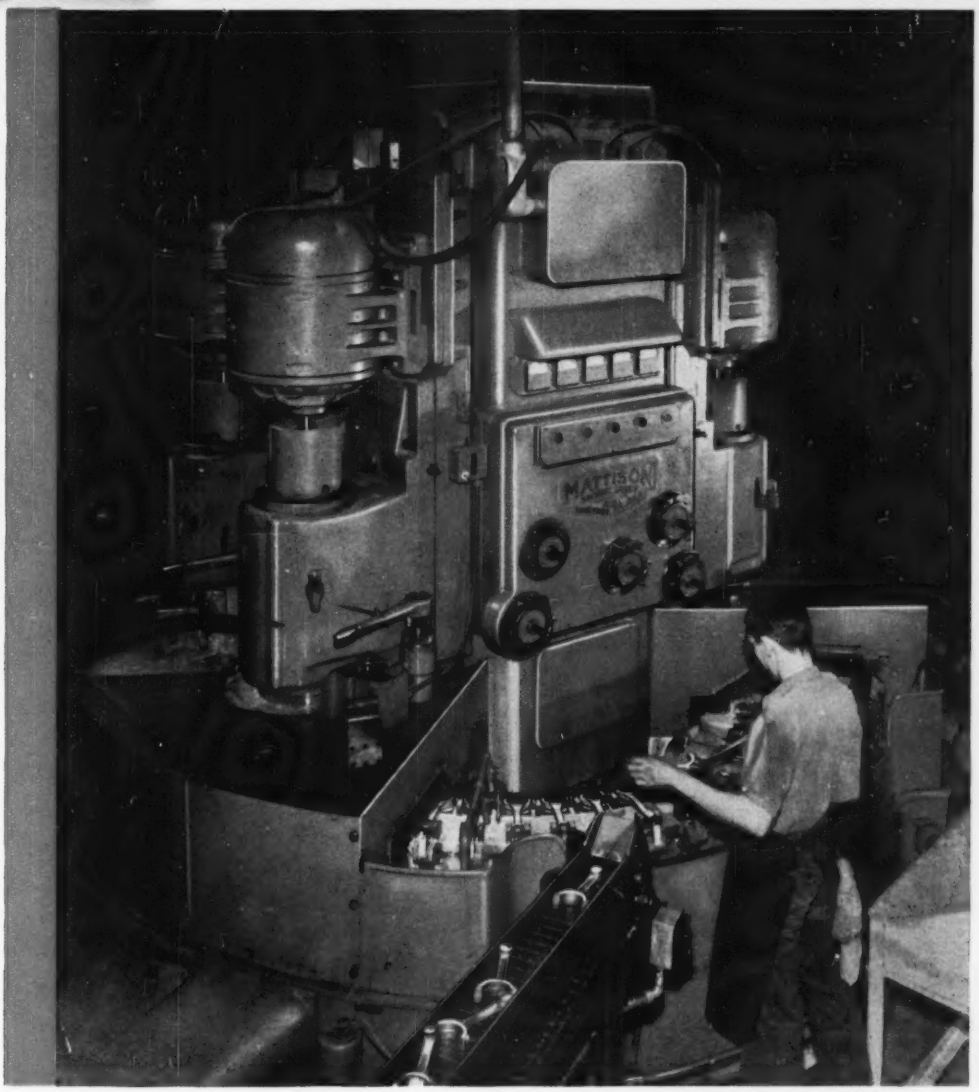
American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MADE IN

ROCKFORD...TESTED ENGINEERING AND CRAFTSMANSHIP

ILLINOIS, U.S.A.



● At the Cleveland Engine Plant of the Ford Motor Company, both sides of wrist-pin and crank-pin bosses are accurately ground on a high production basis with this five wheel Mattison (Hanchett-Type) Vertical-Spindle Automatic Rotary Surface Grinder. Work pieces are held in automatic clamping fixtures. Automatic sizers are constantly in operation checking the work and keeping all pieces within specified tolerances without operator's attention.

This is only one of the many grinders made by Mattison. Whatever your surface grinding problems may be, write us for our recommendations on the proper method and machine for your job.

MATTISON MACHINE WORKS

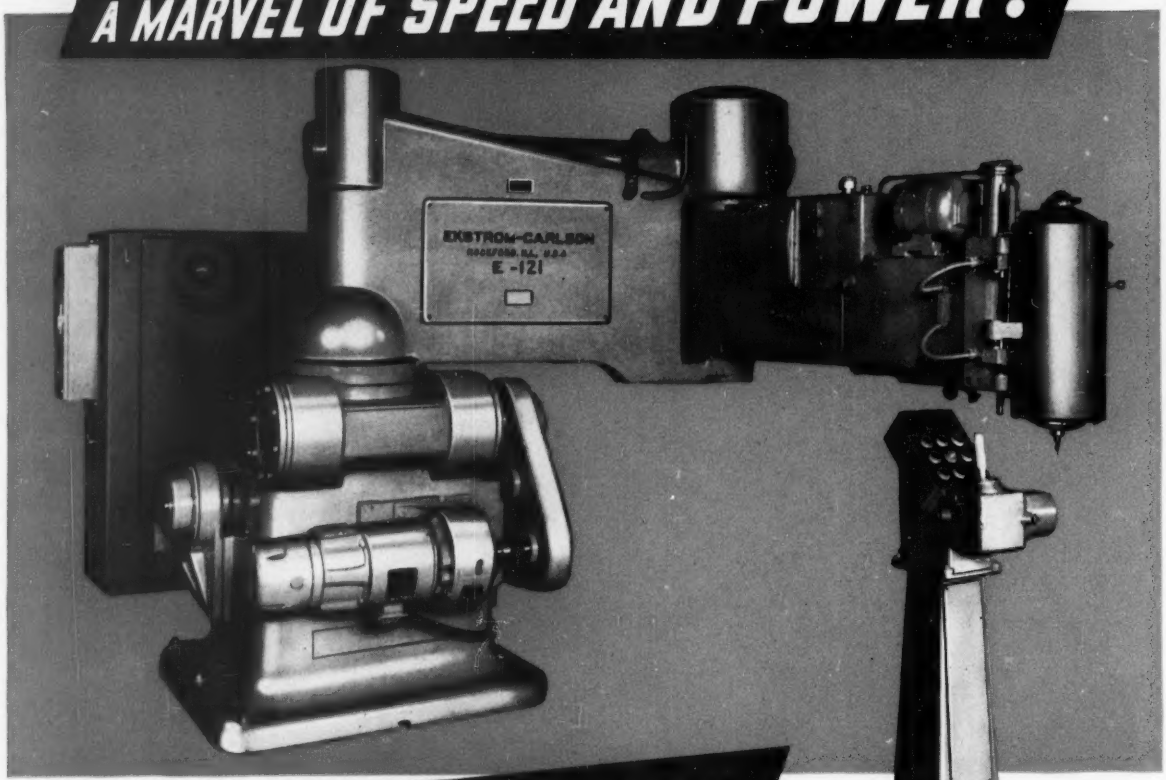
ROCKFORD · ILLINOIS

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...**ROCKFORD**

ILLINOIS, U.S.A.

A MARVEL OF SPEED AND POWER!



FOR CONTOUR ROUTING

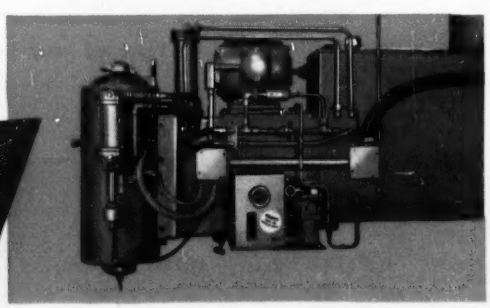
PATENTS APPLIED FOR

EKSTROM, CARLSON E-121 ELECTRIC

Contour Routing and Milling Machine

Here is the newest, most advanced machine for contour routing and milling of aluminum slabs or stacks of sheets up to 2″ thick — easier and faster than it has ever been done before! The EKSTROM, CARLSON E-121 shown above is an all-electric machine with a simple joy-stick controlling both direction and rate of feed. Now, with a minimum of effort, an easily-trained operator, working at a remote control station, can follow complex templates, do inside or outside routing, control depth of cut accurately, change over quickly from one job to another, break production records, and reduce costs. Write *today* for literature giving complete details.

EKSTROM, CARLSON & CO.
Dept M-4
1406 Railroad Ave.
Rockford, Ill.

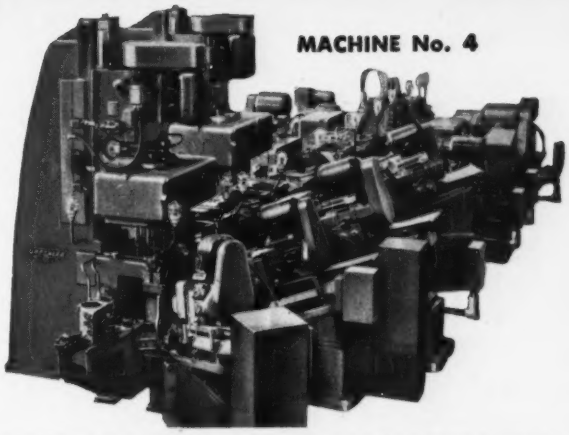


by EKSTROM, CARLSON

MADE IN ROCKFORD... FOR ACCURATE, FAST METAL REMOVAL
ILLINOIS, U.S.A.

208 OPERATIONS IN 44.3 SECONDS

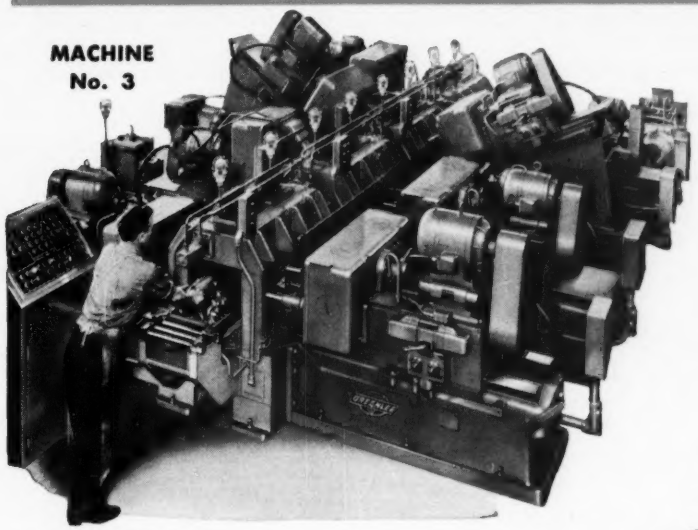
These recently-built Greenlee transfer machines mill, bore, drill, ream, and tap transmission cases for a well-known automobile. A total of 183 tools complete 208 operations in an automatic cycle time of 44.3 seconds. Features include face and end-milling heads, turnover and chip-cleanout stations, and indicator lights for tool changing. Self-contained hydraulic units conform to JIC standards for easy maintenance. These outstanding machines are among the newest built by Greenlee — a pioneer in progressive transfer-machine principles.



MACHINE No. 4

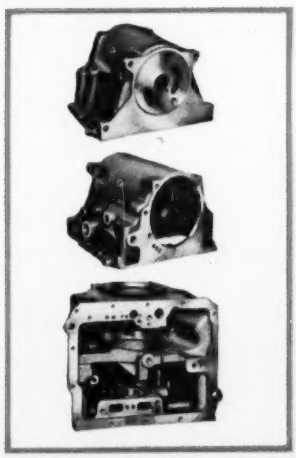
GREENLEE

MACHINE No. 3

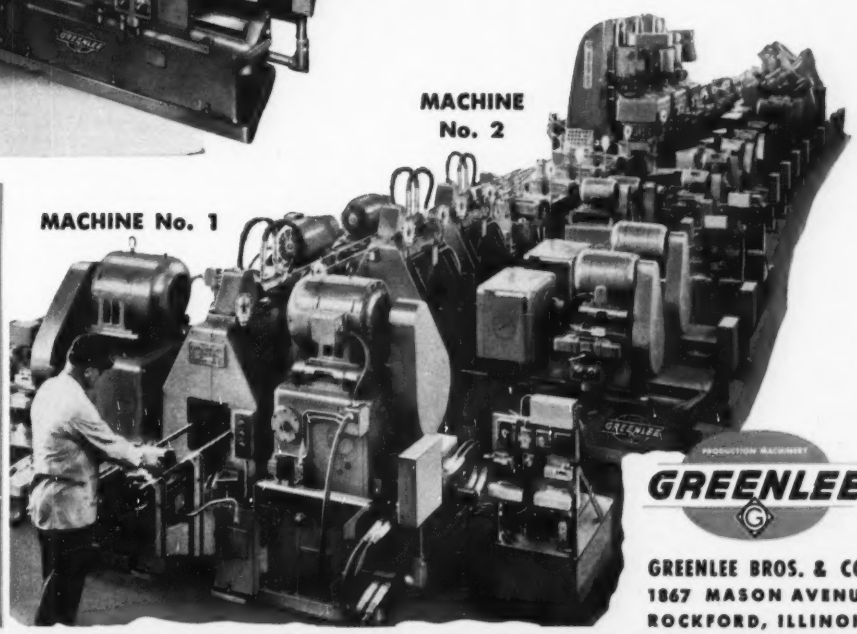


TRANSFER MACHINES
PROCESS
AUTOMATIC
TRANSMISSION CASES
AT THE PRODUCTION RATE OF
65 CASES PER HOUR

MACHINE No. 2



MACHINE No. 1

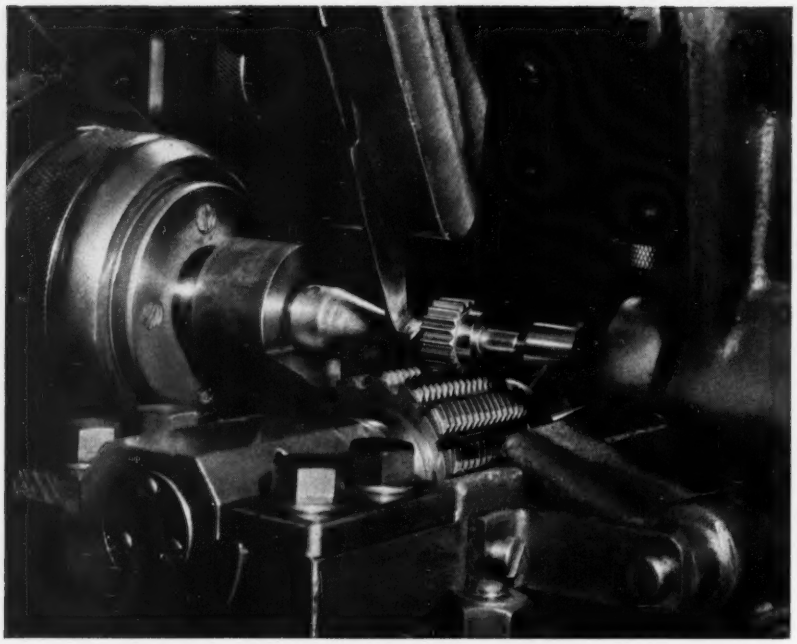


GREENLEE

GREENLEE BROS. & CO.
1867 MASON AVENUE
ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

MADE IN
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... ROCKFORD
ILLINOIS, U.S.A.



COMBINE ACCURACY and PRODUCTION on your HOBBING OPERATIONS

Barber-Colman Hobbing Machines have a basic design which makes it possible for them to be easily tooled to give the required accuracy at the desired production rate. Each job is considered individually to provide maximum efficiency according to your specifications. The machine and tooling are combined to give you maximum production commensurate with the desired accuracy.

An example of the tooling which is available for high-speed hobbing is the high-speed hob swivel with speeds as high as 1800 rpm. Although most jobs cannot utilize these high speeds, this swivel can increase production considerably under the proper conditions. Multithread hobs, quick-acting tooling and automatic loading can also be applied to many high production jobs.

For maximum accuracy, special precision No. 6-10 and No. 16-16 machines are available. These machines are equipped with single-thread index worms to provide maximum tooth spacing accuracy, and the relative rotation of the hob and work spindles is held to precision tolerances. These machines equipped with Barber-Colman Class AA hobs are capable of cutting the very finest hobbed gears at relatively high production rates. Whatever your hobbing problems may be, Barber-Colman has the equipment to satisfy your needs.

BUILDERS OF PRECISION GEAR

MADE IN
ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.

ACCURACY

This 26 D.P. 7-tooth pinion has an outstanding record for both accuracy and production on a Barber-Colman No. 6-10 Hobbing Machine. The feed is .050″ per revolution of the work spindle. Speed of the 2″ diameter hob is 533 rpm cutting B 1113 steel with a double-thread hob. Cutting time for the ¾″ face width is less than ten seconds, and 18,000 pieces are obtained per sharpening of the hob. The maximum adjacent tooth spacing error is .0002″, and concentricity is easily held within the tolerance of .0015″.

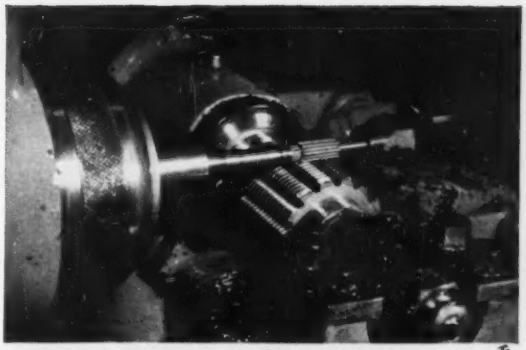
PRODUCTION

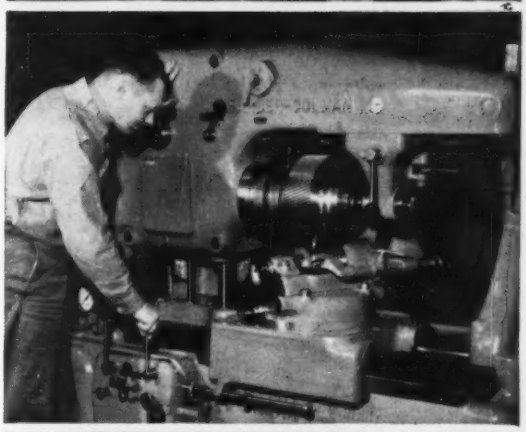
Semi-finish hobbing of these 8 D.P. change gears with 84 teeth is accomplished on a Barber-Colman No. 14-15 Hobbing Machine with a feed of .075″ per revolution of the work spindle. With a five-thread hob, the cutting time per load of two with a 4″ face width is 16.6 minutes. Using a single-thread hob on this job required a cutting time of 66 minutes per load of two. Therefore, although the hob speed is only 105 sfm on a NE8749 steel blank, cutting time was reduced by 75% while maintaining the required accuracy.

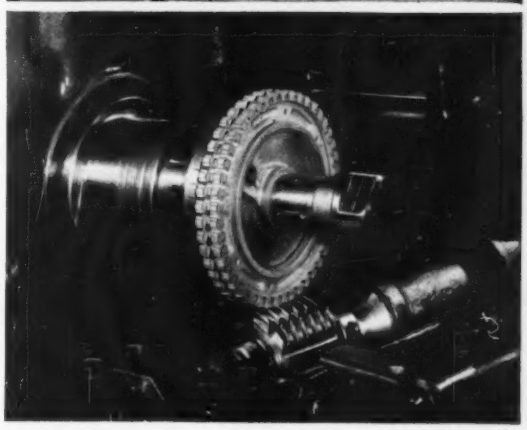
SPECIAL FORM

Form accuracy of the slots on this wheel is important. Hobbing generates the slots with straight and parallel sides having no taper and a minimum undercut of .0005″. Spacing accuracy of the Barber-Colman No. 6-10 Precision Hobbing Machine holds the accumulated spacing error for the 45 slots within .001″. Production is five wheels per hour as compared with two per hour by the previous method.

For a quotation on your specific job, call your nearest Barber-Colman representative or send us a blueprint with the desired tolerances and production.







HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 627 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

MADE IN
ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD
ILLINOIS, U.S.A.

FASTER CHECKING . . . STRAIGHTENING, BALANCING, SCRAPING

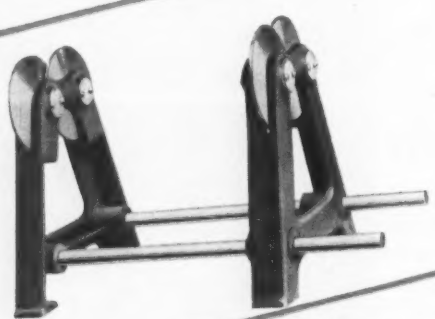
HYDRAULIC POWER PRESS

Built with Stationary or Traveling Ram . . . capacities up to 10, 25, and 50 tons . . . so sensitive and accurate that a shaft may be bent .001". Pressure gauge, indicating ram loading . . . adjustable dial indicator shows amount of shaft run-out in preloaded, fully loaded, and unloaded positions.

Flexible, sensitive control by rotary control valve operated by hand lever. An infinite range of loading up to capacity as lever is moved from 0 to maximum displacement. Push button control of hydraulic unit. Work table, 60" or 108" long. Available attachments include checking rolls, spring loaded centers, adjustable anvils and indicator. To increase production speed, an adjustable stop collar limits the stroke of the ram.

BALANCING WAYS

For balancing, straightening and truing operations. No leveling or centering required. Simply place part to be tested on the four chilled iron discs rotating on supersensitive ball bearings. Made in five sizes . . . 20" to 96" swing.



POWER SCRAPER

Has a "natural hand control" . . . as easy to use as a hand scraper. Left hand serves as guide to the blade . . . right hand controls the stroke. Pressure of left hand controls depth of cut, but forward cut requires no back-breaking labor. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to 3½ feet . . . 60 feet per minute, reverse speed 90 feet per minute. Operator can work at a steady rate without tiring as ¼ h.p. motor does heavy cutting. With this machine one man can do the work of several. The Anderson Power Scraper, mounted on an elevating truck, is easily moved to any location. Machine may be plugged into electric lamp socket and be ready for use. In scraper housing directly across from motor is a scraper blade grinder . . . a convenient, speedy means of resharpening scraper blades without leaving machine.

ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

Send for Bulletin 11-6

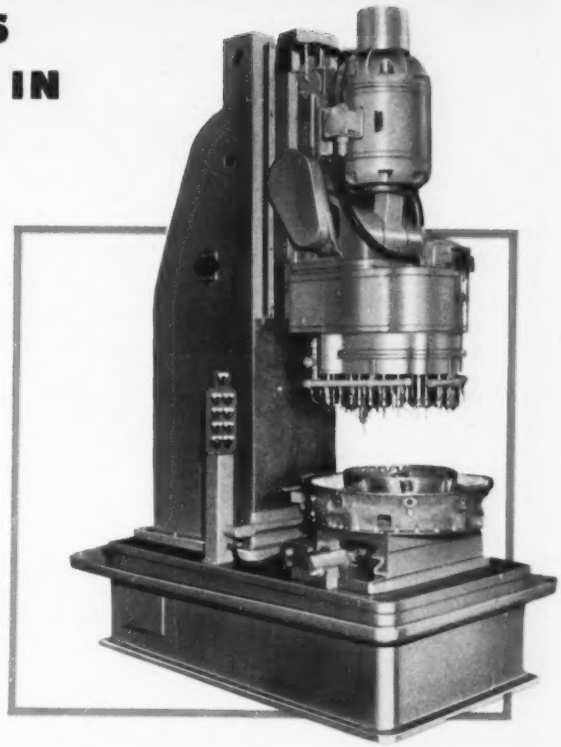
ANDERSON BROS. MFG. CO., ROCKFORD, ILLINOIS

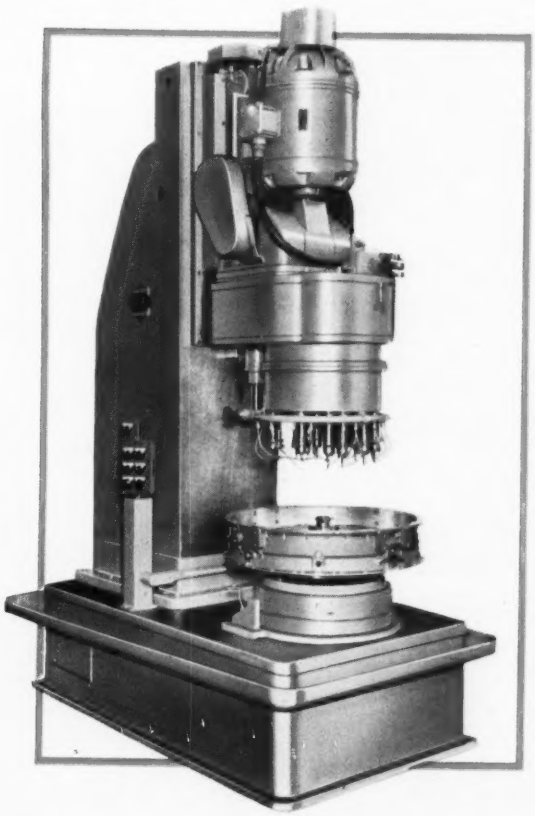
MADE IN ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS ILLINOIS, U.S.A.

Rehnberg-Jacobson

INGENIOUS MACHINES TAP A LOT OF HOLES IN JET ENGINE PARTS...

When a well-known jet engine manufacturer inquired of Rehnberg-Jacobson about a tapping machine, they got more than they expected. Originally asking for means to tap a few holes, they wound up with the two machines shown here — which tap a total of 73 holes. R-J sales engineers, seeing an opportunity, had suggested some ingenious combinations of spindles and index. Result: two machines that provide substantial production-cost savings for the customer . . . a common characteristic of R-J machines, by the way.





ABOVE. *Part:* Front compressor frame for jet engine; material, magnesium. *Machine:* Vertical type, with No. 70 R-J Screw Feed Unit (modified to provide rapid traverse only) driving 27-spindle tapping head with individual lead screw on each spindle. *Operation:* Screw Feed Unit rapid traverses down against positive stop, two holes are tapped as balance of tools clear, motor reverses to extract taps; on automatic cycle, work table moves 3" sideways by air cylinders; 25 holes are tapped as two tools clear, taps are reversed and extracted, and unit rises by rapid traverse to permit unloading. *Capacity:* Rating, 15 pieces per hour.

LEFT. *Part:* Same as above, but turned over. *Machine:* Similar to above, except table has manual rotatable 180° index, and head has 23 spindles. *Operation:* Screw feed unit rapid traverses down against positive stop, 21 holes 1/4"-20 and 5/16"-18 are tapped in proper pattern on 3 concentric radii plus two odd holes on edge; taps retract and unit holds while operator manually indexes piece 180°; tapping operation repeats for a total of 46 holes in symmetrical arrangement, taps are extracted, and unit rapid traverses up for reloading. *Capacity:* Rating, 15 pieces per hour.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

R-J

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

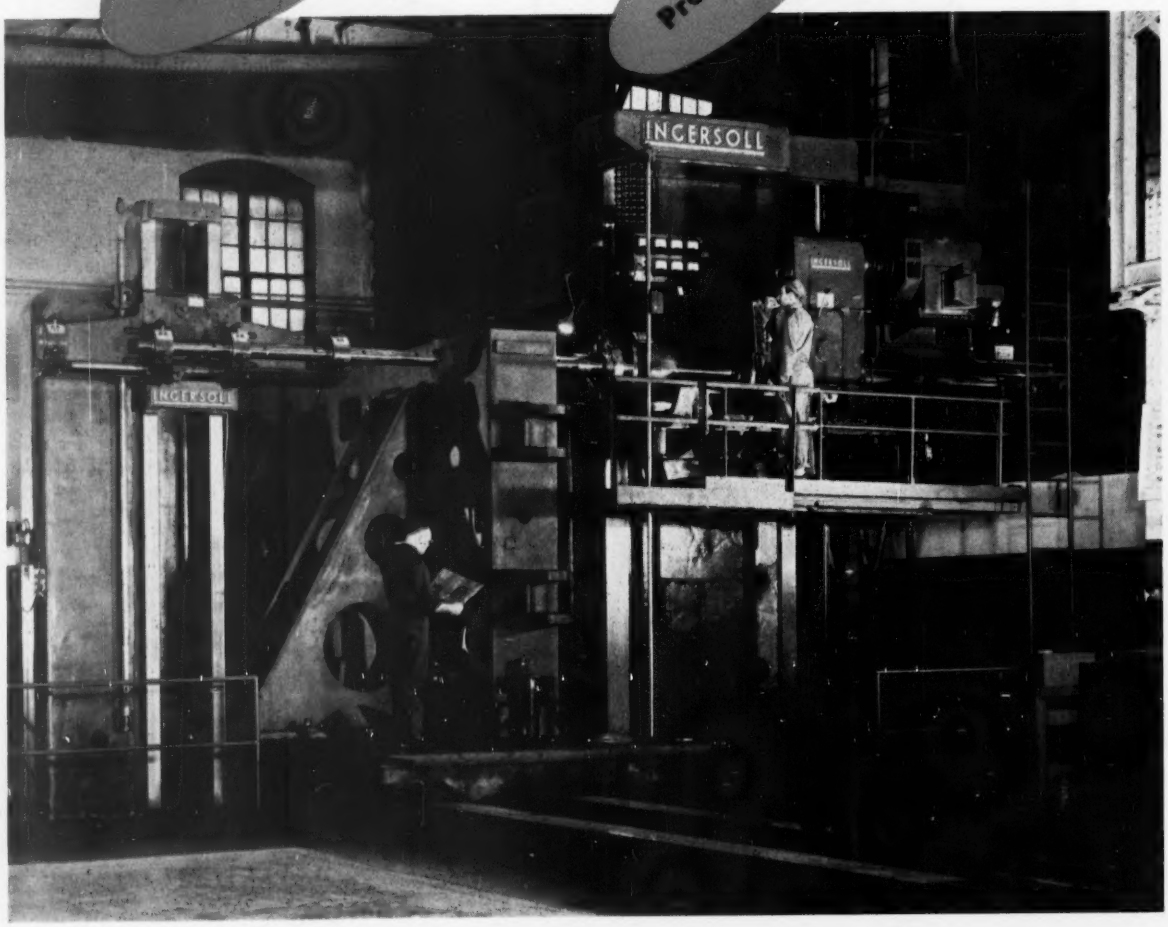
MADE IN
CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD
ILLINOIS, U.S.A.

INGERSOLL 307-TON OPENSIDE

FOR MILLING AND BORING WORLD'S LARGEST POWER SHOVEL PARTS

Designed to fit the Customer's Requirements

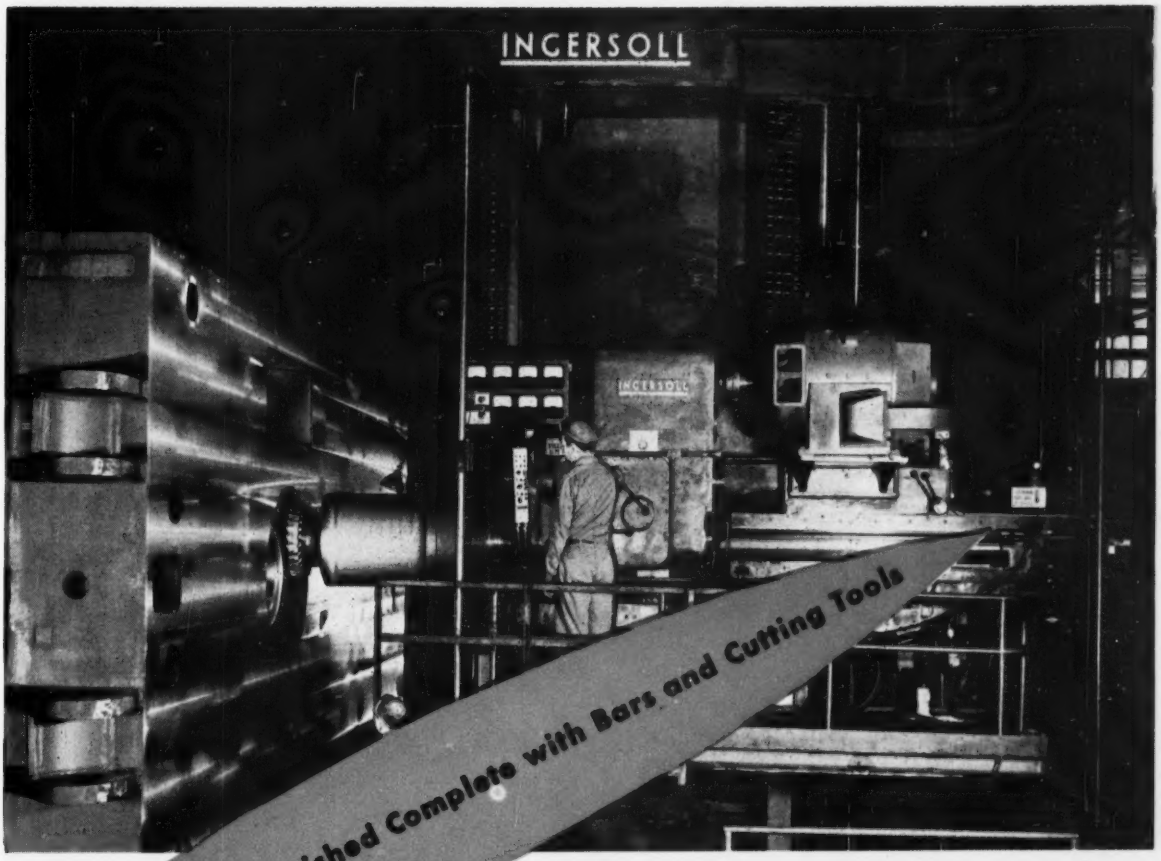
Production and Accuracy Guaranteed



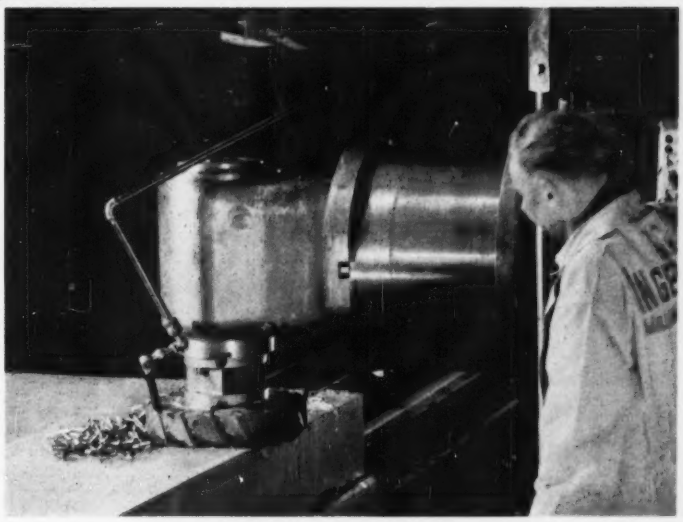
MADE IN

ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS

ILLINOIS, U.S.A.



Machine Furnished Complete with Bars and Cutting Tools



Left: **PUSHBUTTONS, providing full control from the operator's platform, make this big machine as easy to operate as a small one. Boring bars and Ingersoll inserted blade milling and boring tools were furnished with the machine.**

Above: **TO PROVIDE EXTREME RIGIDITY for heavy, accurate cuts, housing is fixed and adjustments are made by movements of the large-diameter quill, thus supporting cutters close to the work.**

Right: **INGERSOLL RIGHT-ANGLE ATTACHMENT can be indexed to any point in full circle for machining surfaces perpendicular to the face of the head without resetting the work.**

THE INGERSOLL MILLING MACHINE COMPANY, ROCKFORD, ILLINOIS

MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD

ILLINOIS, U.S.A.

HANDLE TOUGH JOBS EASILY with ROCKFORD HYDRAULIC SLOTTERS

Rockford Hydraulic Slotters are your easiest method of machining large irregular pieces, internal surfaces, and angular or rotary cuts.

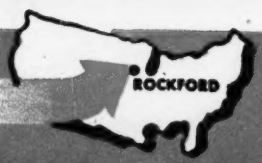
Rockford Slotters sharply reduce cutting time on your cumbersome jobs. Setups are quick and simple. Hydraulic cross, circular and longitudinal feeds give you maximum slotter flexibility. And Hydraulic drive supplies constant speed, simply selected.

Ask a Rockford Machine Tool Co. representative to recommend the Rockford Slotter for your needs.

Hy-Draulic

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

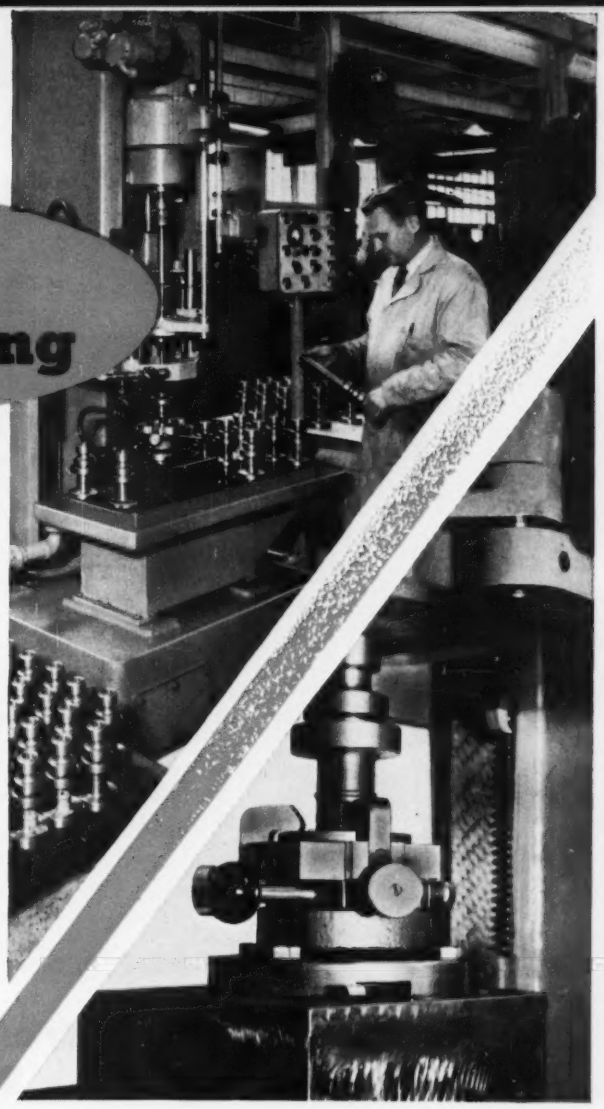
MADE IN
ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION
ILLINOIS, U. S. A.



These Gear Blanks HONED and SIZED

with

BARNESDRIL Plugmatic Sizing



AUTOMATICALLY To .0002"

Bore-to-Bore for Size, Roundness, and Taper

These precision gear blanks are honed on a new No. 223 BARNESDRIL Honing Machine equipped with BARNESDRIL Plugmatic Bore-To-Bore Sizing. All subsequent gear operations are held relative and close accuracy from bore-to-bore is very important. Bores are 1" diameter x 6-1/2" long. A 2-spindle machine is used for greater production — cycle 24 seconds, stock removal .004" to .005".

Each bore honed is positively gauged. A master gauge with a self-leading nose is positioned in a floating holder. As the honing tool cuts to final size, the gauge drops into the bore and by electric controls terminates the honing cycle.

This new method offers you one type of sizing for regular, counter-bored, or blind end bores. Write for full information on this New Production Method for Finishing and Sizing. Ask for Bulletin B5005.

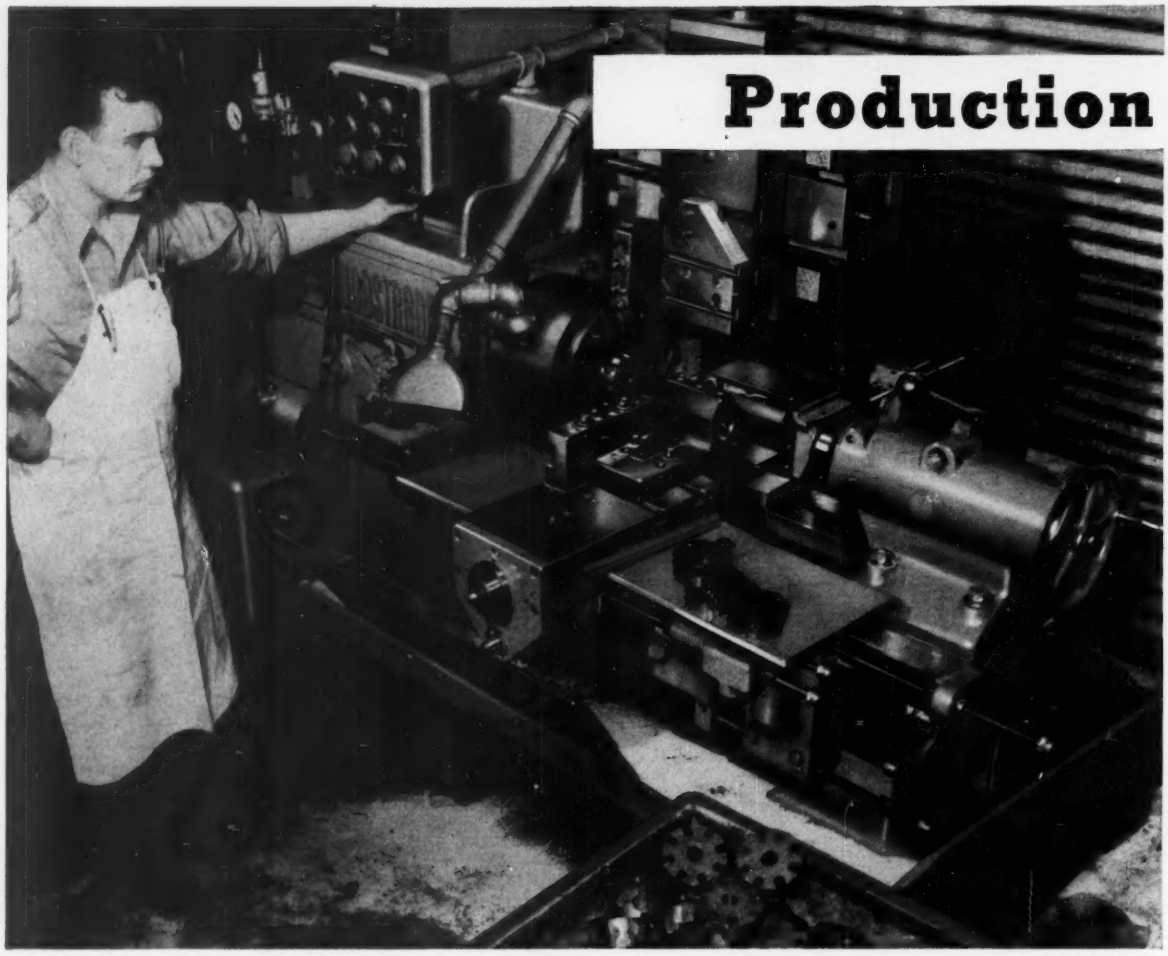
BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

ILLINOIS, U.S.A.



One Sundstrand Automatic Lathe Replaces 3 Other Machines

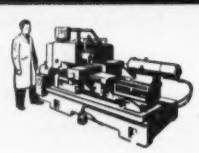
Here's a Sundstrand Model 8A Automatic Lathe in operation in the Columbia Tool and Die Company of Minneapolis. It is used for turning and facing five different pump rotors and three different covers. Previously these parts were turned on three different conventional turning machines using three operations. With this one Sundstrand installation, the same amount of work is done 2-1/2 times faster. Production increases and savings like these are commonplace with Sundstrand Automatic Lathes. Investigate their possibilities on your work. A Sundstrand engineer will be glad to help. There is no obligation for this service.

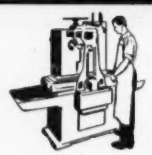
SUNDSTRAND

*"Engineered Production" Service**

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



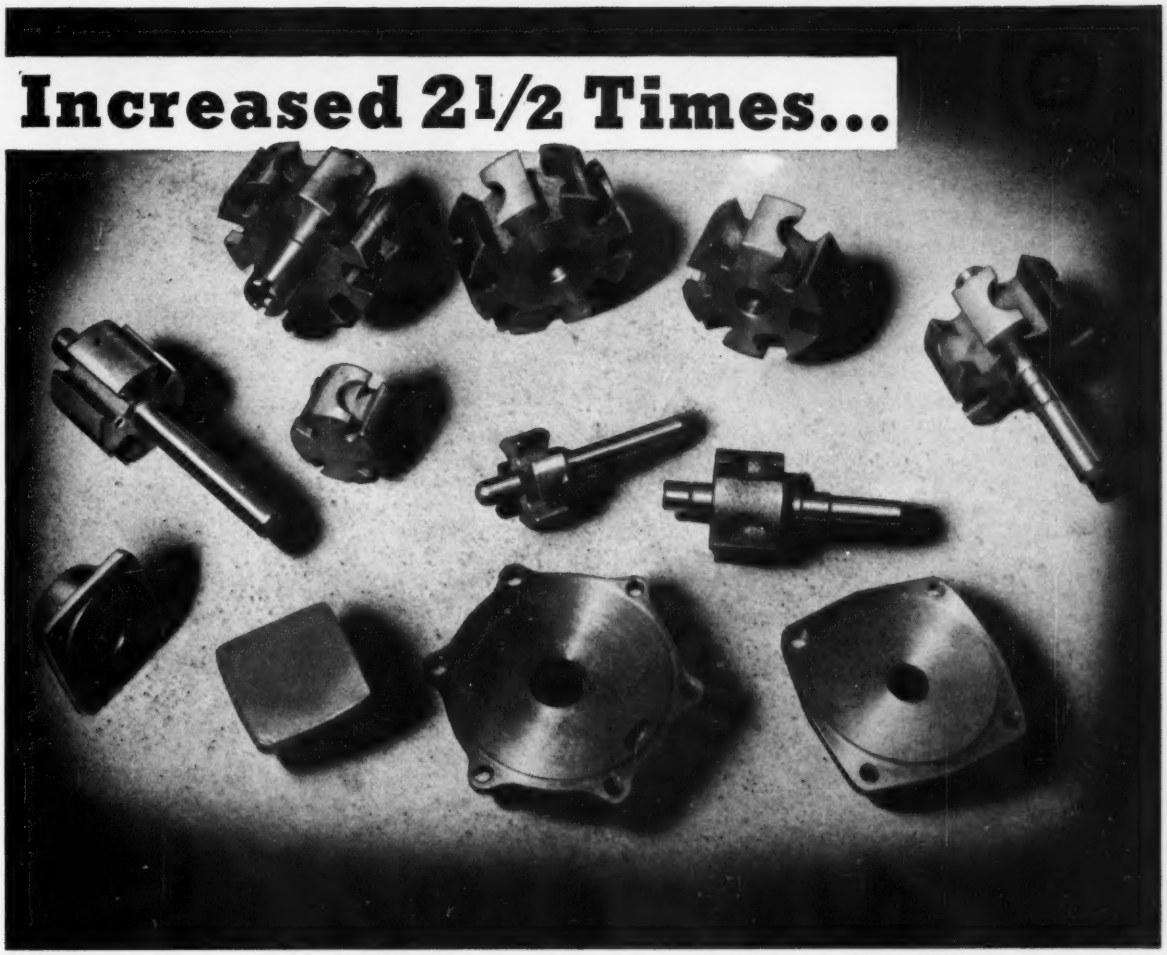


MADE IN

ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

ILLINOIS, U.S.A.

Increased 2½ Times...



...In Lot Sizes of 100 to 500 Parts

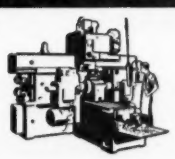
Parts are turned in lot sizes of 100 to 500 pieces. Operations consist of.. (1) Face one side, turn 1/2 of O.D. and core drill . . (2) Face opposite side and turn opposite end.. (3) Finish face both sides. Production for each operation on parts of Ni-resist material is 60 per hour — on cast iron parts, 120 per hour.

Work is held to .001″ tolerance. Simplicity of set-up is the most important factor in making the multiple-tooled Sundstrand Automatic Lathes practical and profitable on short-run turning.

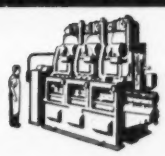
Free Data

The complete line of Sundstrand Automatic Lathes includes the Models 4A, 6A, 8A, 12A and 16A ranging from 3 to 75 HP. Write for complete information on these machines today. Ask for bulletin 633.

TRIPLEX RIGIDMILS



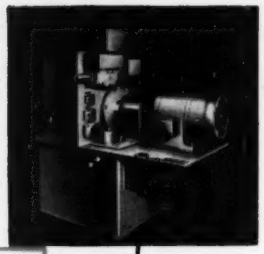
SPECIAL MACHINES

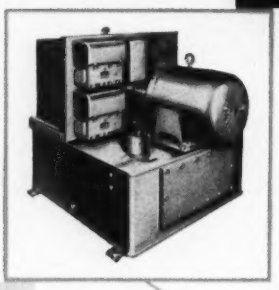


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

MADE IN
FOR METAL REMOVAL WITH ACCURACY AND SPEED...ROCKFORD
ILLINOIS, U.S.A.

alone

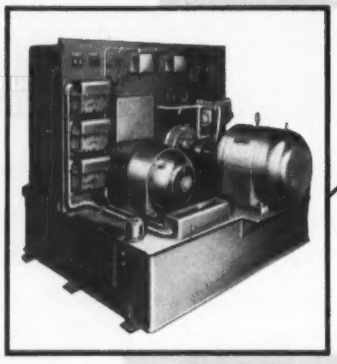




BARNES

HYDRAULIC

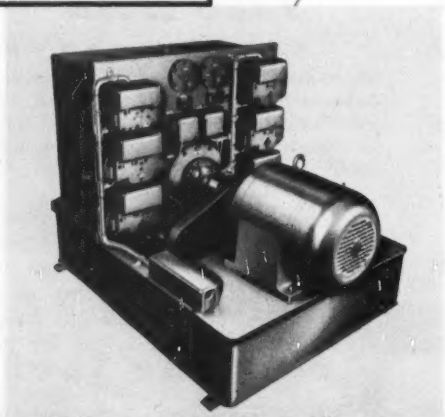
POWER UNITS



The various elements supported by the units are so arranged as to facilitate servicing by maintenance men such as: electricians, hydraulic servicemen, fixture servicemen, tool makers, etc.

All units are uniform in design and arrangement of elements — differing only in size.

Attention — please note that regardless of unit size, the location of all elements remains the same.



BRANCH OFFICES

503 New Center Building
Detroit 2, Michigan

3254 Lincoln Avenue
Chicago 13, Illinois

132 East Hanover Street
Trenton 8, New Jersey

SALES REPRESENTATIVES

Rees Machinery Company
1012 Empire Building
Pittsburgh 22, Pennsylvania

B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada

W. H. Del Mar Co.,
3931 W. Slawson Ave.
Los Angeles 43, California

Barnes Machine Tool Power Units conform to the JIC Code.

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JOHN S. BARNES CORPORATION ROCKFORD, ILLINOIS

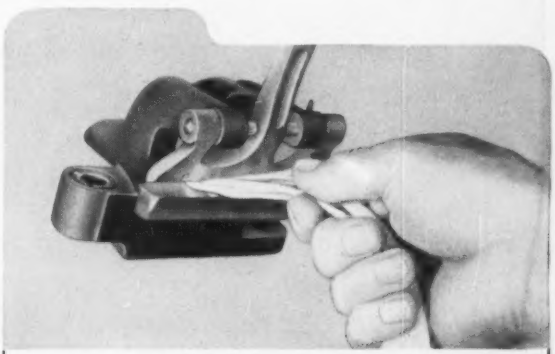
MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

FACTS
...About a Straight Chrome Stainless Steel That Shows Unusual Promise for Your Applications...

If your products or components call for the properties of a stainless steel, here is a stainless that shows unusual promise for many applications. And this steel (Carpenter No. 3, Type 443) is particularly important today for jobs requiring an improved straight chrome stainless to replace the 18-8's restricted by Government Regulations. Carpenter Stainless No. 3 gives you *excellent corrosion resistance, high resistance to scaling,* and a *low annealing temperature (500°F lower than type 304).* Moreover, No. 3 provides machinability comparable to SAE 3145, 3250 or 4650. For more information on No. 3—its mechanical properties, relative workability, corrosion resistance, recommended uses, etc.... drop us a line on your Company letterhead for the new descriptive folder on Carpenter No. 3.

Typical user reports on Carpenter Stainless No. 3

This rod end bearing for military aircraft must have heat resistance, ability to resist salt corrosion, good machinability and good cold forging qualities. *Carpenter No. 3* has met all these requirements and is giving an excellent account of itself both as to corrosion and heat resistance at operating temperatures up to 1000°F. Moreover, No. 3 is not subject to intergranular corrosion at this temperature.



These jaw inserts for tenter clips grip and stretch nylon cloth as it rolls through finishing stages. Inserts must be spotless and must resist corrosive action of the dyes because a slight surface defect could break the threads. In addition to good corrosion resistance, *No. 3* gave the inserts high wear resistance for long service—including resistance to abrasion from talc and china clay used in other textiles processed.

A word about availability...

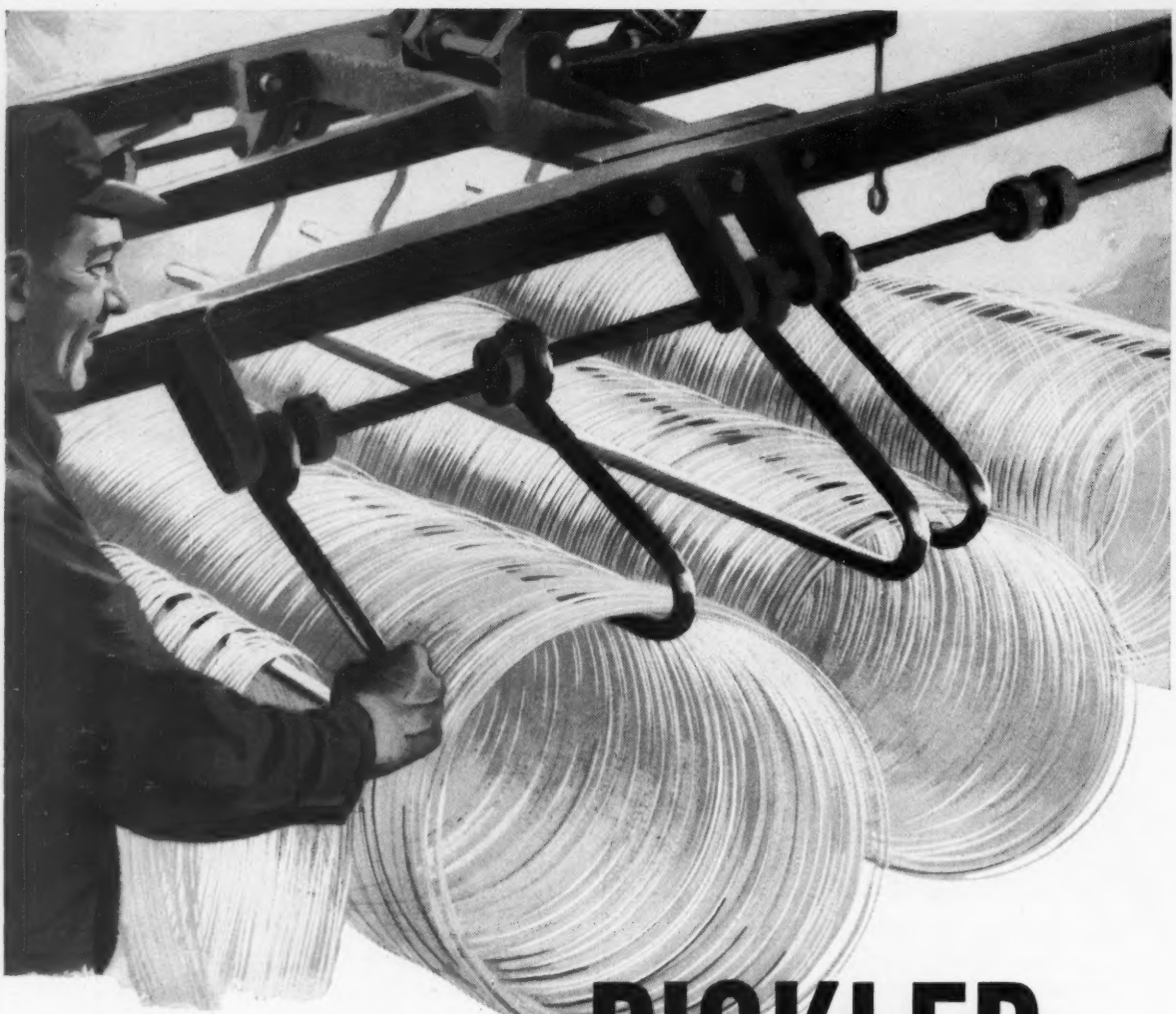
Carpenter Stainless No. 3 (Type 443) is available from Reading Warehouse Stocks, hot rolled annealed in sizes ⅜" to 2¾" round. Other standard bar sizes and finishes, also cold rolled strip, are manufactured to order in minimum quantities of 500 pounds per size. Mill shipments are currently 60 to 120 days from receipt of order and neither priorities nor allotments are required.

THE CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Carpenter STEEL — **Stainless Steel**

pioneers in improved specialty steels

Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor



PICKLED

to bring you CHASE® wire with a clean, bright finish

Be sure you're getting clean, even tempered brass or copper alloy wire, free from physical defects. Ask for Chase wire by name.

We check constantly on the dimensions, color, surface condition and temper of Chase wire to make sure the wire you get is entirely uniform. Only a flash pickle is required to make Chase wire clean and oxide-free because carefully controlled annealing assures a high lustre, excellent surface texture and uniform color.

Cut your production costs with Chase wire. Write for free booklet giving shapes, sizes, alloys and tempers available.

Chase® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

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Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester†	(†sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)

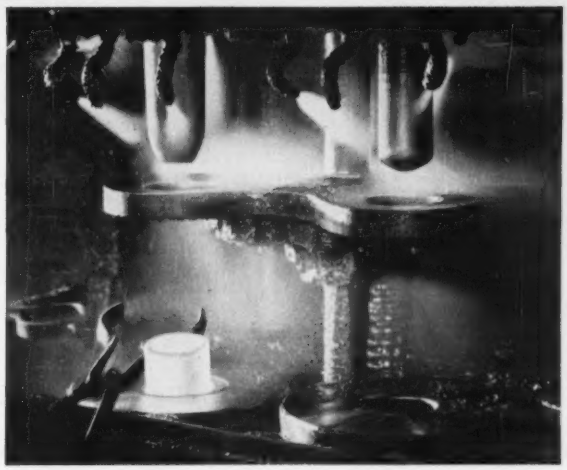
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation

FOR 81 MM MORTARS—Steel slugs, at left, are cut from 2½-in. round bars of carbon steel; next, the slugs are upset (center).

Heated to 2100 F, the upset slugs are extruded and formed into rough cups (right). The final product, not shown, is then cold shaped to close tolerances.



SCENE OF ACTION—In this 1600-ton press, the upset slugs, heated to 2100 F, are cupped by the extruding punch at upper right. The forming die, at upper left, then shapes the cupped piece to more accurate shape. High-pressure jets of mixed air and water keep the punches and dies cooled to about 550 F. Punches and dies, made from Cr Mo-W tool steel, are hardened and double-tempered to produce a hardness of Rockwell C-50.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Care is required when cutting tool steel with abrasive wheels.

Cutting annealed tool steel with an abrasive cut-off wheel can cause both fine cracks and scorching on the surface unless certain precautions are observed.

Proper wheel speeds and the liberal use of coolant will help to avoid this sort of trouble. If these precautions are ignored, the excessive heat generated is often so intense that an annealed steel is actually hardened.

If the steel is heated above the critical range, the rapid conduction of heat to the adjacent cold steel serves as a quench. Hardnesses above Rockwell C-60 are often produced on surfaces which have been cut in this manner. Attempts to drill or machine such surfaces will result in trouble because the hardness is often high enough to make machining impossible.

Slugs Formed Into Mortar Shells 500 an Hour, at 2100 F

Production men at the Ordnance Division of Rheem Mfg. Co., San Pablo, Calif., have good reason to be pleased with the long service life they've been getting from extrusion punches and forming dies made from our Chrome-Moly-Tungsten hot-work tool steel.

Hot slugs, to be processed into mortar shells, are extruded into a cupped shape by punches at the rate of 500 an hour. Because they are in such frequent contact with the slugs, heated to 2100 F, the temperature of the punches seldom falls below 550 F, even though the punches are sprayed with an air and water mixture.

The production men and tool designers at Rheem figured the punches would produce a maximum of 3,000 to 5,000 pieces before failure. Instead, one punch extruded 30,860 pieces; others produced 14,000 and 16,000.

The hot-forming dies, which form the cupped piece into more finished shape, are subjected to the same high temperatures. After forming 15,000 cups, one of these dies was polished and put back in service; it turned out another 63,000 pieces before it showed much wear.

Cr-Mo-W is an all-around hot-work steel containing 5 pct chromium. It's especially suited for jobs that involve both shock and repeated cycles of heating and drastic cooling. It's easy to machine and heat-treat; and it's highly resistant to heat-checking when water-cooled.

Cr-Mo-W hardens in air and distorts very, very little during heat-treatment. It's widely used for gripper and header dies, shear blades, trimmers, die-casting dies. Like to have more details? Write for Booklet 265. Address your request to Publications Dept., Bethlehem, Pa.

An experienced spark-tester can identify the basic composition of this bar of tool steel. Can you?

KNOW YOUR SPARKS

The exact composition of a tool steel cannot be determined except by a laboratory analysis. However, the spark test is often convenient when bars of several different compositions become mixed.

Even amateurs sometimes use the spark test with good results by spot-grinding a bar of known analysis and comparing the spark stream with bars of unknown composition. A small-diameter grinding wheel, rotated at high speed to produce a generous flow of sparks, is recommended for this test. Note the illustration.

Some elements such as carbon, tungsten or molybdenum have characteristic appearances in the spark stream. Other elements such as silicon and nickel modify the appearance of other elements.

Perhaps you are expert enough to recognize the sparks at the left. They indicate a steel having a fairly high carbon content (0.90 pct) and some tungsten (0.50 pct). It's our BTR, most popular of the general purpose, oil-hardening grades.

Each Achieved With the Right REPUBLIC COLD DRAWN ALLOY STEEL BARS

Here are examples of alloy steel parts made by Republic customers. Each was searching for a certain outstanding characteristic . . .

One wanted the edges of a set-screw for a coal-cutter chain to be tough enough to resist rounding off when dragging through a coal seam deep in a mine . . .

The next one wanted an automobile water-pump shaft hard enough to resist thousands of miles of high-speed service without becoming worn and leaky . . .

The third wanted a socket-wrench with a socket that was stronger than the heaviest-handed mechanic . . .

All three manufacturers called in the Republic Field Metallurgist . . . discussed their three different problems with him . . . got a triple-distilled alloy-choice that was part his, part the Republic Mill Metallurgist's, part the Republic Laboratory Metallurgist's.

Each customer is using a different Republic Cold Drawn Alloy Steel Bar grade . . . all three got the high surface quality, the close dimensional tolerance, the high strength, and the UNIFORM MACHINABILITY that helped cut production costs, increase tool life, improve product quality.

Want to try Republic 3-Dimension Metallurgical Service on *your* production problems? A call to your Republic District Sales Office will start action.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

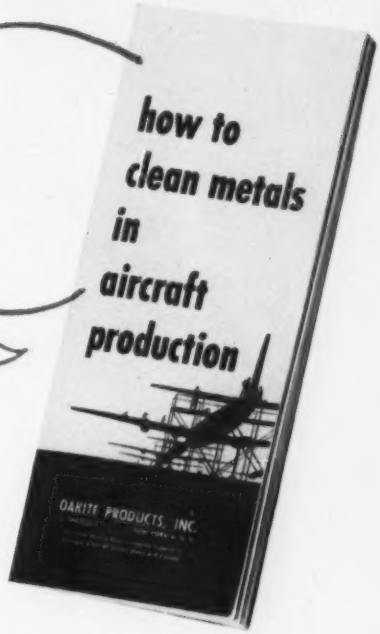
LAB FIELD MILL
3-DIMENSION Metallurgical Service

...combines the extensive experience and coordinated abilities of Republic's *Field*, *Mill* and *Laboratory* Metallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in countless industries to the correct steel and its most efficient usage. IT CAN DO THE SAME FOR YOU.

Republic COLD DRAWN
ALLOY STEEL BARS
REPUBLIC STEEL

HAVE YOU SEEN THIS BOOKLET?

IT TELLS HOW TO DO THE HARD JOBS



Better cleaning cuts costs in aircraft production. This 48-page illustrated booklet outlines all the big cleaning jobs. Have you seen the latest Oakite recommendations on:

¶ How to clean aluminum in preparation for anodizing? *See page 4.*
¶ How to prepare aluminum for spot welding? gas welding? heliarc welding? *See pages 10 to 14.*
¶ How to remove welding flux? *See page 14.*
¶ How to prepare aluminum for painting? *See page 15.*
¶ How to clean aluminum before and after heat treating? *See page 20.*
¶ How to strip paint from aluminum? *See page 22.*
¶ How to clean magnesium? *See page 27.*
¶ How to select and install cleaning tanks, rinse tanks and sprays, and spray-washing machines? *See pages 31 to 35.*
¶ How to treat water in paint spray booths? *See page 36.*
¶ How to clean engine test cells? *See page 40.*

FREE Write for your copy of the booklet. You'll find added interest in the Oakite Aluminum-Cleaning Chart covering the cleaning, etching, de-smutting, de-oxidizing and pre-paint treatment for many alloys.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE PRODUCTS, INC.
26 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*

*Name*_____

*Company*_____

*Address*_____

Propeller Shaft Forgings Require Special Skills to Produce

Skilled metallurgists produce special electric alloy steel for these forgings at National Forge. The steel must have high resistance to fatigue, wear and shock. After rough machining and carefully controlled heat treating, these forgings are precisely machined to close tolerances by skilled machinists. The finished shafts are ready for installation.

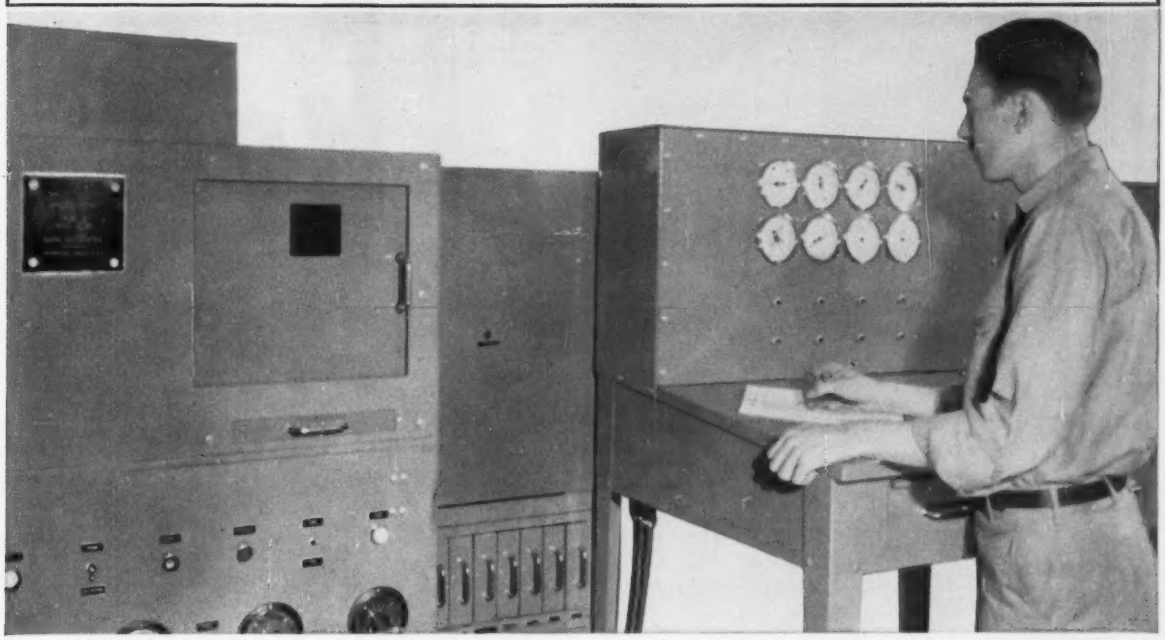
These special skills were developed at National Forge through years of close cooperation with the aircraft industry. This has given National Forge a complete understanding of the quality requirements both in material and machining.

Why not put this experience and skill to work for you when next you need forgings? Write for full information.

NATIONAL FORGE AND ORDNANCE COMPANY

IRVINE, WARREN COUNTY, PENNSYLVANIA

Rigidly controlled chemistry



Another reason why you get uniform, high-quality forgings with TIMKEN® forging steels!

YOU can be sure of uniform forgings when you use Timken® forging steels. That's because the quality of Timken forging steels is rigidly controlled, from melt shop all the way through final inspection, by the most precise methods known.

For example, the direct-reading spectrometer shown above chemically analyzes a molten heat of Timken forging steel in just 40 seconds. And a complete analysis report is given to the melt shop within 10 minutes! First of its kind in the steel industry, it's just one of the many ways the Timken Company controls quality at every step in production.

Your order for Timken forging steels is handled individually in our mills. We target conditioning procedure to your particular forging requirements. You can hold rejects to a minimum. And you save steel because the good dimensional tolerances of Timken steel forging bars produce uniform weight multiples with a minimum of steel lost in flashings.

You're assured of uniform physical properties, too, when you use Timken forging steels. They respond uniformly to heat treatment—from bar to bar and heat to heat. Fewer furnace adjustments are needed. And Timken forging steels have uniform grain size after heat treatment. Result: forgings made from Timken forging steels have uniformly high ductility and resistance to impact.

For help in improving the quality of your forgings and cutting production costs, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

They

ARE ALWAYS READY!

Bunting Standard Stock Bearings

Completely machined and finished—ready for assembly—Bunting Standard Stock Bearings can be immediately installed in most machine tools and industrial machinery. Unusual requirements are quickly and economically met by slight additional finishing. Your local Bunting distributor stands ready to serve you at all times from his large stocks.

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Your Bunting Distributor is an industrial distributor or a specialist in certain industrial items. You will find him listed in the classified section of your telephone book—most likely under the heading Bars, bronze or Bearings, bronze. If he is the leading distributor, he almost certainly is the Bunting Distributor. He carries in stock, for your money saving convenience, completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars in a complete range of sizes meeting all your usual production and maintenance needs. Ask him for catalog.

Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

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wherever you are...

it's still the same

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
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SPECIFY
YOUR TOOL STEELS
BY
THESE
BRAND NAMES

And that goes for Crucible's REX High Speed Steels, too. For all of REX High Speed Steels are subjected to extensive metallurgical tests – microscopic examinations, chemical analysis, ultra-sonic checks both in the billet and finished form, magnetic analysis, and strength tests – to assure you of uniform quality regardless of when or where you buy them.

This *uniformity factor* distinguishes Crucible's REX High Speed Steels from other brands. Next time you order high speed steel, be sure you consider this all-important factor. When you do, we're sure you'll specify the Crucible REX brand.

WRITE TODAY for the unique Crucible Tool Steel Selector, 9" diameter, in 3 colors – a twist of the dial tells you which tool steel is best for your application. Address your request to Crucible Steel Company of America, Dept. M, Oliver Building, Pittsburgh 22, Pa.

CRUCIBLE first name in special purpose steels

TOOL STEELS

53 years of Fine steelmaking

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

News About Created-Metals

Cuts Inventory 50% with Standard Tools

A leading appliance concern recently reported: . . . "As a result of suggesting to the responsible Process Engineering group standard tools which would perform the same service at an initial purchase saving, as well as a substantial saving in procurement time, our inventories of so-called special cutting tools have been reduced by more than 50%."

News about the new Carboloy MTI Plan indicates that it is designed to work similar benefits for cutting-tool users.

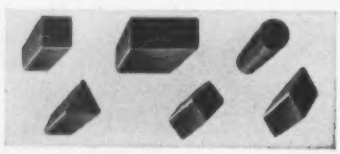
Details can be had by writing the Carboloy organization (address at right).

★ ★ ★

Complete Line of Insert Blanks

With the addition of two new diamond-shaped styles, the Carboloy line of carbide blanks for insert tools is now complete.

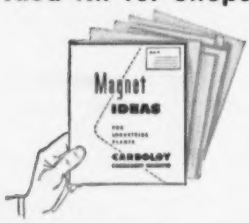
Available in 12 sizes, the styles



are square, rectangular, round, triangular, 55° diamond and 80° diamond. Blanks are available from Carboloy stocks or from Authorized Distributors.

★ ★ ★

New, Free Magnet Idea Kit for Shops

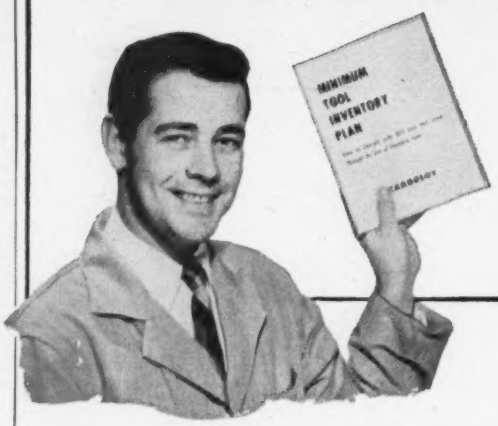


A handy, new literature kit showing the how's and why's of permanent magnets is currently sparking shop men to real savings in time and money.

The magnets have proved very effective as sheet steel separators, magnetic stands, tool-holding devices, sweepers' "pickup" tools and tool retrievers, to name a few uses.

Kit can be obtained free from Carboloy Department of General Electric Company. (See address at right.)

YOUR CARBOLOY FIELD REPRESENTATIVE SAYS . . .



"This reduces

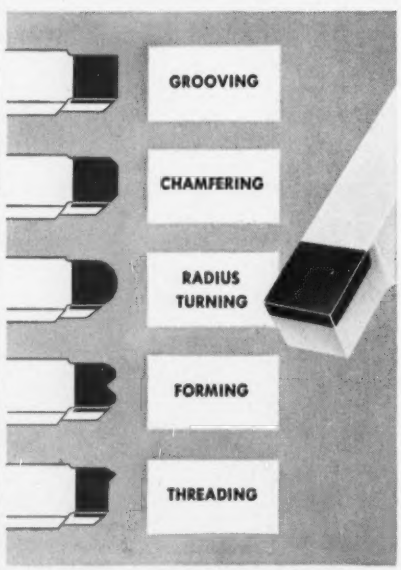
"It's an astoundingly simple, practical way for you to benefit from the low cost, wide adaptability and quick availability of Standard Carboloy Tools.

"Briefly, here's how the Minimum Tool Inventory Plan works: Instead of loading your shelves with special, made-to-print single-point carbide tools, you stock a lesser number of Carboloy 'Standards' . . . always available from distributors' stocks nearby. The MTI Plan shows you how to convert these Standards, *in minutes*, to handle about 80% of your special jobs.

"Your operating efficiency stays at par or improves. Your inventory goes down – about 30% or more. You cut out tooling delays, save on initial tool investment and tool cost. You streamline your inventory procedures, reduce tool waste . . . get many other benefits shop-wide.

"Send coupon for MTI Plan Kit."

1 ADAPTABLE for up to 80% of your single-point tool jobs



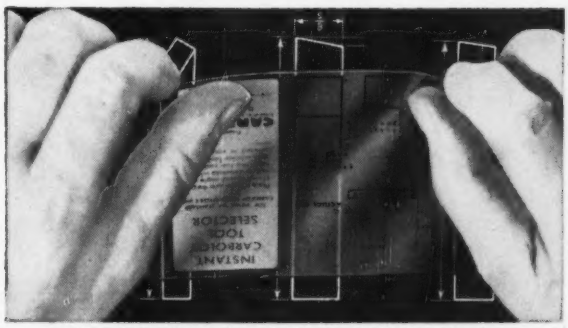
Above is a Style C Standard Carboloy Tool. It can be used "as is" for some jobs, or ground quickly to many special shapes. Five typical ways it can be adapted are shown.

There are only 11 styles of Standard Carboloy Tools . . . ready to be used "as is" for general turning, facing and boring . . . or quickly ground on regular carbide grinding equipment to fit those tricky special jobs. With Standards, you need *fewer* tools to do *more* jobs. Thus, you operate on lower inventories.

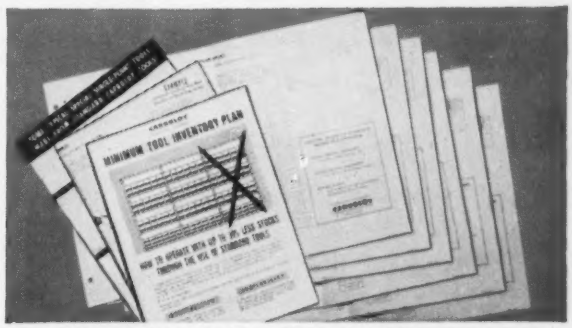
2 AVAILABLE always from nearby Carboloy distributors

You can get off-the-shelf delivery on Carboloy Standards in 98 cities from coast to coast. No waits. No production delays as with special, made-to-print carbide tools. Knowing you can get such speedy delivery of Carboloy Standards means you can cut your inventories still more.

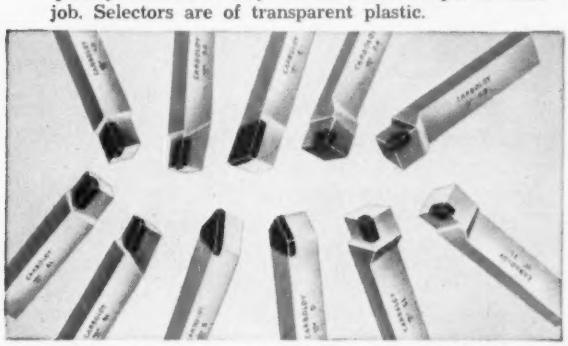
new Carboloy MTI Plan
your tool stocks up to 30%"



3 **Free MTI Plan Kit** includes two handy tool selectors. You place them over your special prints, find out quickly which Carboloy Standard best adapts to each job. Selectors are of transparent plastic.



4 **Kit also includes** Plan Sheets in which to tabulate your Standard Tool selections, and easy-to-follow Grinder Sheet which outlines simple way to convert the Standards to your job specifications.



5 **At once you'll see** how you can operate with up to 30% fewer tool stocks. Next step is to phone your nearby Carboloy Distributor for swift delivery on *only* the Standard Carboloy Tools you need.

6 **Should you have** the slightest difficulty getting the plan rolling, a Carboloy sales representative will call at your plant, help you smooth out the kinks. His expert services won't cost you a penny.

SEND COUPON TODAY—PINNED TO YOUR COMPANY LETTERHEAD—
FOR YOUR FREE MTI PLAN KIT

CARBOLOY TOOLS ARE STOCKED COAST TO COAST BY

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

Look under "Tools" in the Yellow Pages of your local telephone book or in Thomas' Register for your nearby Carboloy Distributor. He has complete local stocks and services. Ask him about the MTI Plan.

"Carboloy" is the registered trademark for the products of the Carboloy Department of General Electric Company.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11147 E. 8 Mile Road, Detroit 32, Michigan

☐ Please rush me, at no cost or obligation, your MTI Plan Kit.
☐ Have your sales representative call, without obligation.

Name _____ Position _____
Company _____
Address _____
City _____ Zone ____ State _____

MADISON-KIPP *Fresh Oil*

. . . FED UNDER PRESSURE BY THE MEASURED DROP

the most dependable method of lubrication ever developed!

This lubricator becomes an integral part of a machine tool in which there are 48 vital bearings that require dependable lubrication. The Madison-Kipp mechanism is so compact that the reservoir measurements are only 4" wide, 19¾" long by 5¾ high."

There are six different models to meet almost every application requirement. Please write us for all details regarding your particular lubricator requirements.

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WISCONSIN

kipp

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

If you make any parts like these....

Piston Pins	Jacks
Pump Cylinders	Gun Barrel Drills
Axles (front and rear)	Axle Housings
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Airbrake Parts	Bobbins
Drag Links	Push Rods
Table Rollers	Rocker-Arm Shafts
Exhaust Lines	Hollow Spindles
Drill Shanks	Shock-Absorber Casings
Frame Spacers	Spring Bushings
Grease Guns	Ironer Rolls
Armature Bodies	Tie Rods
Hydraulic Brake Lines	Drill Collars
Filler Tubes	Torque Tubes
Hydraulic Hoist Cylinders	Spool Holders
Ignition Wire Tubes	Golf Shafts
Radio Parts	Transmission Parts
Bushings	Spindle Caps

you can make them

better, faster and at less cost

with SHELBY SEAMLESS STEEL TUBING

BECAUSE Shelby Seamless comes to you with the basic shape and hole already made you can eliminate or greatly reduce many time and labor-consuming operations connected with boring and machining. You also save the wear and tear on expensive tools, as well as the needless waste of steel.

Another important advantage in using Shelby Seamless Tubing is that its excellent machining characteristics and uniformity speed up production and improve the quality of your output. *You can turn out parts by the millions and the last part will be as metallurgically and dimensionally accurate as the first part produced.*

Shelby Seamless Steel Tubing is available in a complete range of sizes; in different wall thicknesses; various finishes and steel analyses. Our engineers will be glad to submit recommendations based on a study of your particular requirements.

All Shelby Seamless Tubing is pierced from solid billets of uniform steel. This is the one manufacturing method that assures absolute uniform wall strength.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S SHELBY SEAMLESS MECHANICAL TUBING

USS

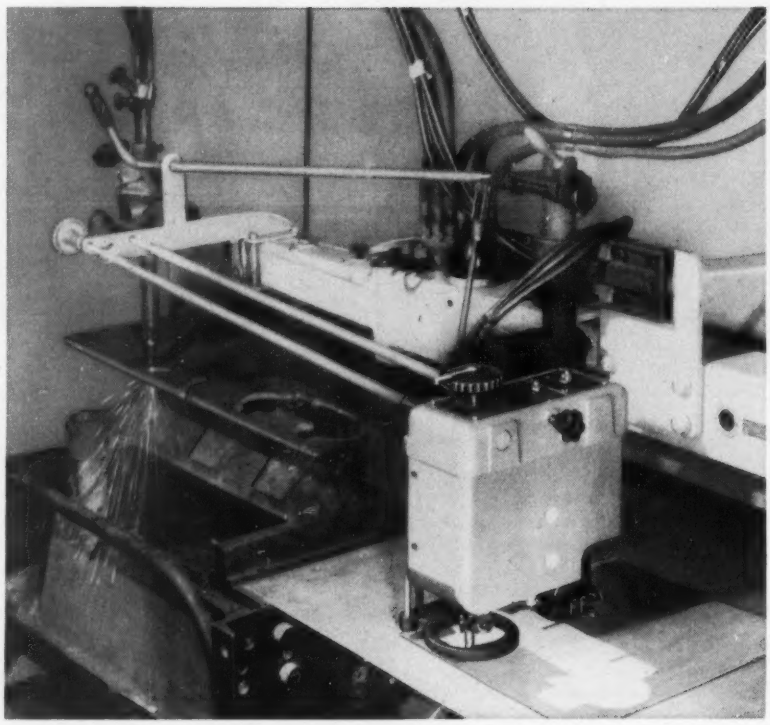
UNITED STATES STEEL

SIMPLIFY Your Shape-Cutting Jobs with the . . .

OXWELD Automatic Tracer

Trade-Mark

- Positive templet contact . . . electronic steering control . . . maximum tracing accuracy
- Templets are easy to make, low-cost
- No kerf allowance required in templet
- Intricate shapes easily reproduced
- Dynamic braking prevents overruns
- Local or remote controls . . . simple to operate



With an OXWELD Automatic Tracer to guide your oxygen-cutting machine, you need never forego the advantages of templet tracing because of time or cost. Whatever the shape—whether you need one piece or many—templet requirements are simple. Just draw your templet, full size, on a thin sheet of inexpensive plastic. Then cut it out with scissors or knife. It's that quick and easy. There's no tedious forming. To compensate for kerf width, just set a handy dial on the Tracer.

The OXWELD Automatic Tracer follows practically any templet shape within extremely close tolerances. It can also be used to hand trace directly from blueprints or drawings. Drive action is smooth and steady with both single- and multiple-blowpipe setups.

Your nearest LINDE representative will be glad to help you plan an OXWELD Automatic Tracer installation to fit either your present shape-cutting machine or one of the available OXWELD Shape-Cutting Machines.

WRITE TODAY FOR FREE BOOKLET F-8086

Linde
TRADE-MARK

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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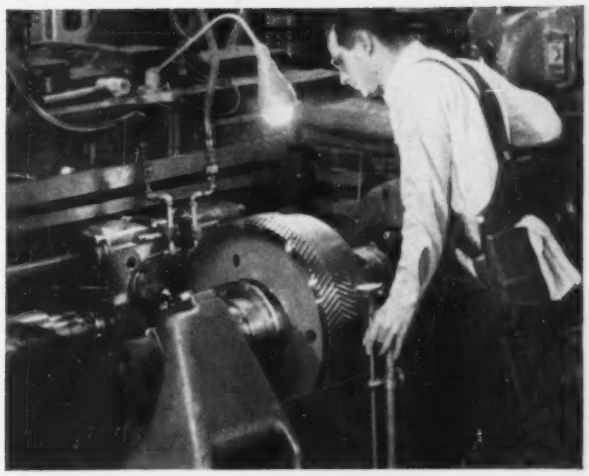
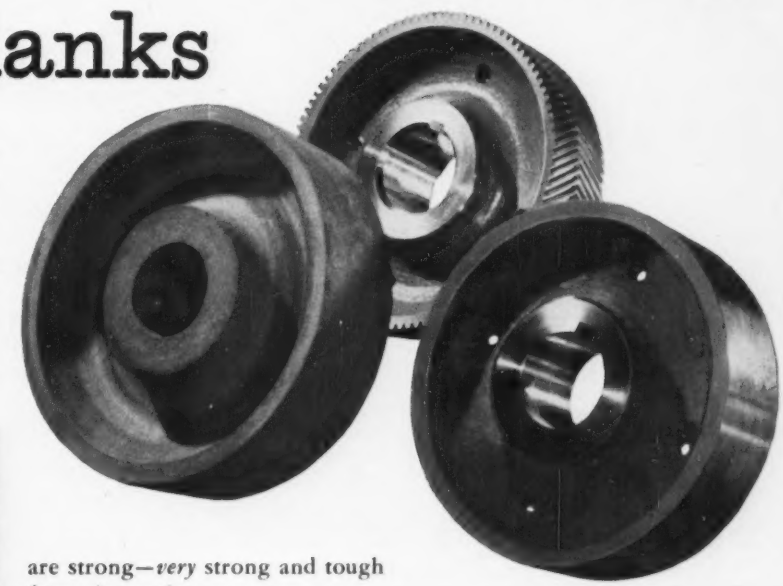
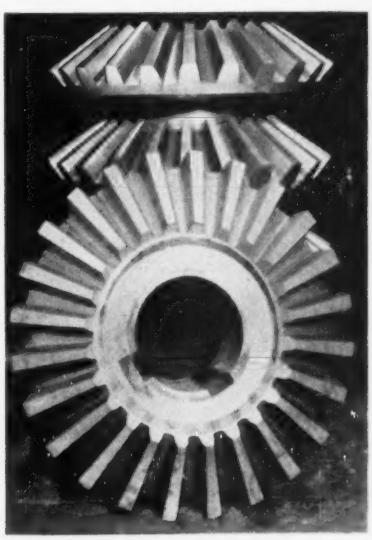


Facts

about some very strong gear blanks

Bethlehem makes gear blanks by a special process involving both forging and rolling—a process resulting in uniform density of metal and excellent grain flow. Because of the firm, solid steel all the way through, the blanks machine dependably and easily, with no hidden trouble down beneath. And they





are strong—*very* strong and tough from rim to rim.

They are made in the only mill of its kind in the world. Available heat-treated or untreated, these sturdy Bethlehem blanks are unsurpassed for spur, bevel, miter, herringbone, and other types of gears. And you can get them in a wide range of sizes—approximately 10 to 42 in. OD.

Care for more details? We'll gladly furnish all you want . . . together with helpful Booklet 216, which is yours for the asking.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

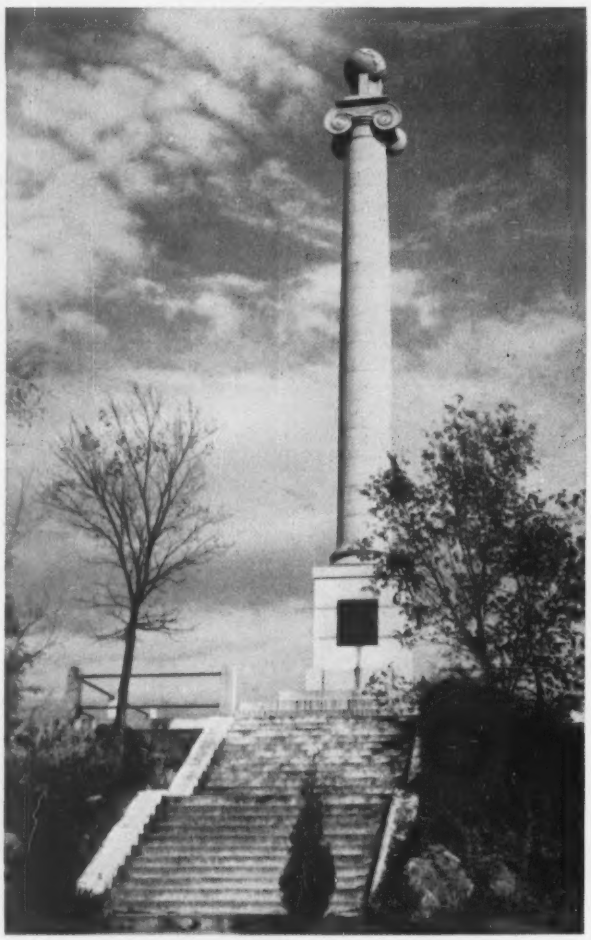
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM ROLLED-and-FORGED CIRCULAR PRODUCTS

CUMBERLAND GROUND BARS

We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".

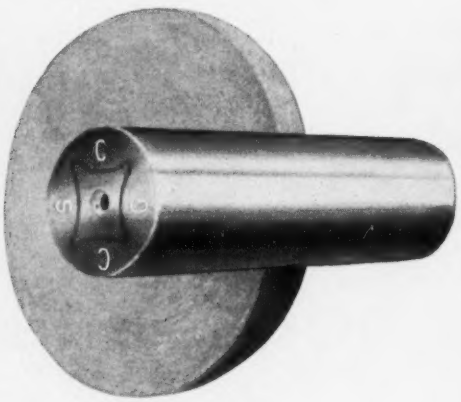


ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

DISTRIBUTED BY

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, N. Y.—Jos. T. Ryerson & Son, Inc.
Cambridge, Mass.—Brown-Wales Company
Charlotte, No. Carolina—Edgcomb Steel Co.
Chicago, Ill.—Central Steel & Wire Co.
Cincinnati, Ohio—Jos. T. Ryerson & Son, Inc.
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New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
Philadelphia, Pa.—Charles Bond Company
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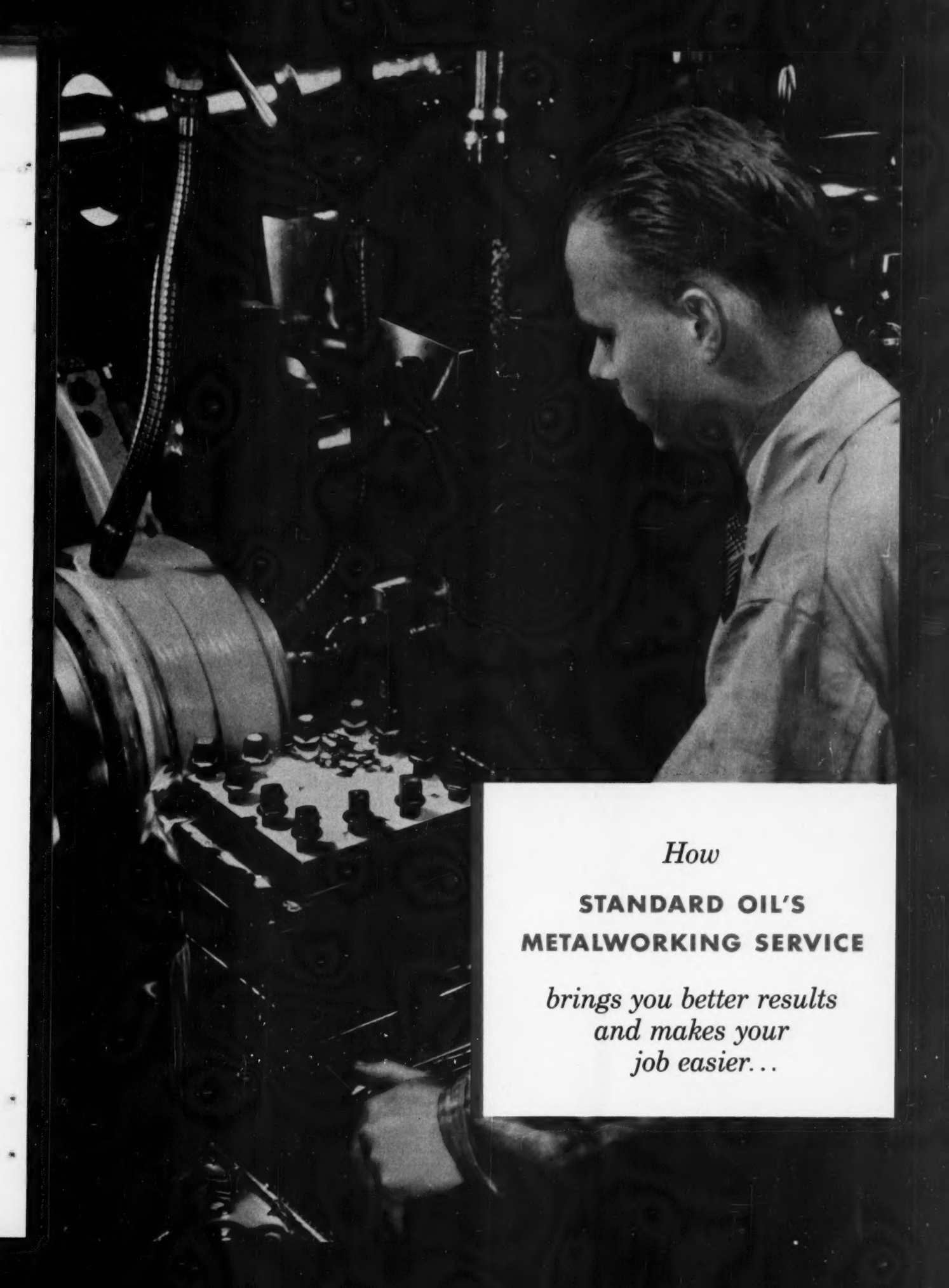
CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892



How

STANDARD OIL'S METALWORKING SERVICE

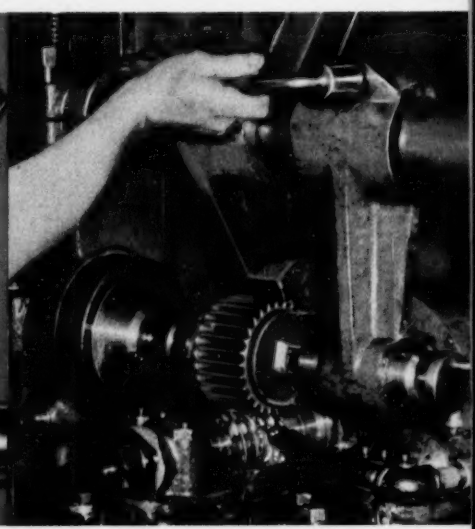
brings you better results and makes your job easier...

Standard Oil's Metalworking Service brings you the right product...for the right job...right on schedule!

There's no other like it in the Midwest! Standard Oil's Metalworking Service is completely personalized to meet your individual needs. It brings you one of the most complete lines of metalworking products on the market. It offers you the help of a specially trained, experienced metalworking specialist who has headquarters near your plant. It gives you delivery of metalworking products from a warehouse that's right in your own backyard. Described here are the outstanding products in Standard's complete line. You'll find exactly the ones to give you the best results.

STANICUT 62FC increased screw machine production of aluminum alloy valves from 97 to 125 per hour . . . gave better finish and longer tool life—5,000 pieces between tool grinds. This light-colored oil is ideal for tough non-ferrous jobs.

STANICUT 107 BC handled wide variety of operations for midwest plant. Metals machined include brass, copper, bronze, aluminum, and steel. This cutting oil gives fine results on high speed operations using free cutting steel where requirements are not too severe and low cost is important.



PREMIER Cutting Oil extended hob life 75% and increased production of spur gears made from free machining steel. Available in two grades, Nos. 110 and 150, this sulfurized and compounded oil meets demands for a low-priced, light-colored, general-purpose cutting oil.

ACME Cutting Oils cover wide range of operations. They are dark-colored, sulfurized mineral oils. Grade No. 80 for high speed automatics . . . No. 110 for general automatic work, deep drilling . . . No. 150 for high speed operations and broaching . . . No. 200 for low speed operations and severe work.

STANICUT Cutting Oils are special-duty products developed to meet today's most exacting requirements and highest production schedules.

STANICUT Oil 117 BCS for high speed operations where steels of lower machinability than free cutting screwstock are used.

STANICUT Oil 126 BCS, relatively light-colored oil, contains right amount of active sulfur for rather severe, high speed operations.

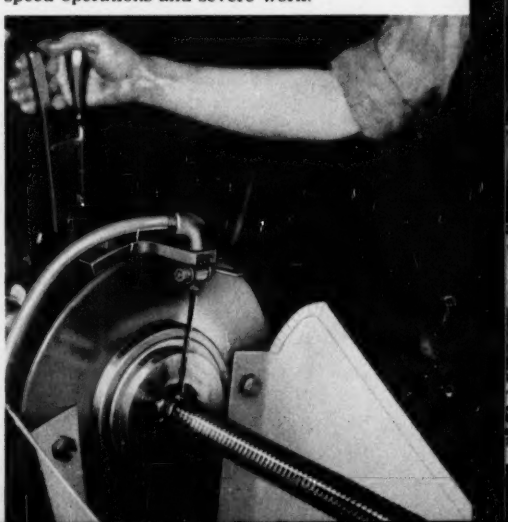
STANICUT Oil 137 BCS has a high sulfur content and special compounding for severe, high speed operations on either turret lathes or automatics. Suitable for either brass or steel.

STANICUT Oil 155 CS, containing maximum active sulfur and chlorine, for very tough alloys of SAE 3000 and 4000 series, especially those that tend to "smear."

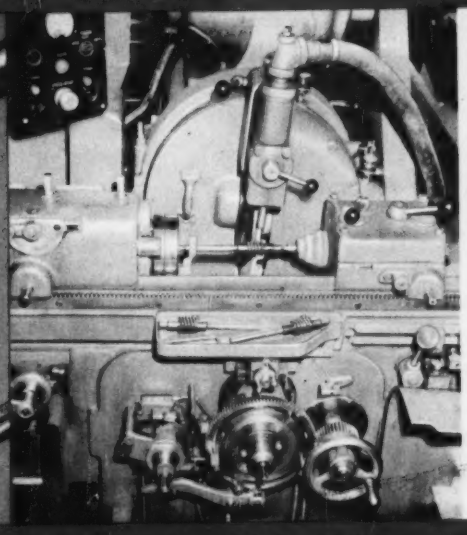
STANICUT Oil 166 BC—may be used as a dual-purpose oil for those desiring this type of product—non-corrosive, provides lubrication for bearings yet chlorinated and compounded sufficiently for cutting operations on free machining steels, brass and copper.

STANICUT Oil 208 BCS, high sulfur and chlorine content, yet good color and odor . . . for tough alloy steels and severe operations.

STANICUT Oil 309 BCS, a sulfurized and chlorinated oil, for heavy broaching, threading, and tapping of soft stringy steels. Can be blended with paraffin oil to handle less severe work.



SUPERLA Soluble Oil provided excellent finish on saw blades made from high carbon steel . . . prevented any rust troubles. This general-purpose soluble oil coolant mixes readily in all waters. It is stable, non-gumming, non-irritating. **SUPERLA Soluble Oil No. 2** is a lighter soluble oil especially suited for use with soft to medium-hard water.



STANDARD

STANCOOL No. 2 Soluble Oil handled more jobs for a midwest plant than could conventional soluble oils, gave good results in tapping, threading, drilling, and milling of high carbon, high chrome steels and stainless steels. Special compounding enables this oil to handle severe cutting jobs.

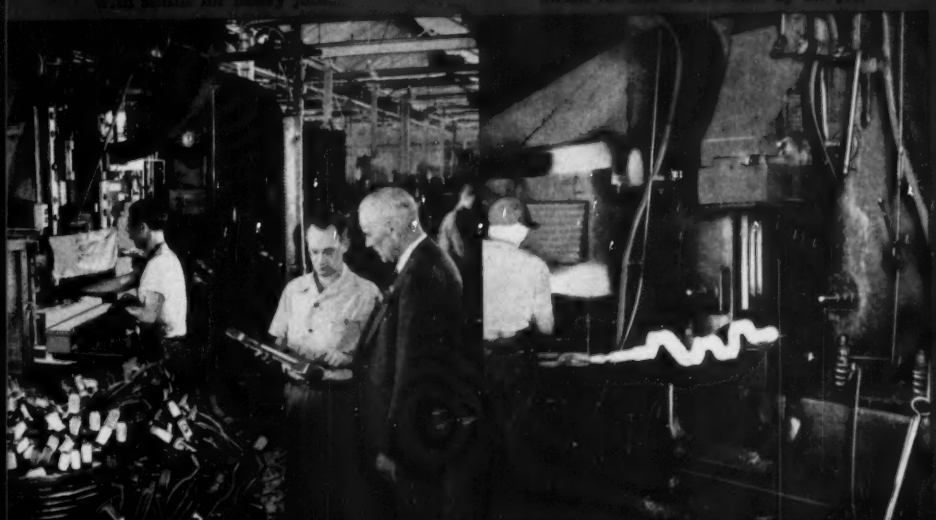
STANDARD Compound "C" set die polishing on this stamping job—50,000 more pieces between polishings. Two grades of STANDARD most widely used compounds found in sheet metal processing: Grade "C" for average jobs, easy removal . . . Grade "S" with sulfur for heavy jobs.

SUPERLA Thread Grinding Oil "A" stopped burning of surfaces on worm gears, increased grinding speed 20%, gave finish of between 14 and 20 microinches. Each of three grades has the proper viscosity, compounding, sulfur and chlorine to produce best results in service intended.

STANOLIND Forge Oil Compounds have increased materially life of dies and tools in forging of hot metal. STANOLIND "Medium" has heavier consistency for general work. STANOLIND "Heavy" is especially suited for intricate forging. Both can be applied by swab, further distributed by air jet.

SEND FOR THIS VALUABLE HANDBOOK. It's a handy, pocket-size manual packed with facts and information helpful to shop men. Published by Standard Oil Co. and S. [illegible] Co., Chicago, Ill.

HERE'S HOW Standard Oil's metal-working fluids make your job easier . . .



Standard Oil's Metalworking Service makes your job easier three ways... bringing you all of the metalworking products you need...

1 *Backed by an active technical and research program*

In one of the world's largest industrial laboratories, research experts not only work to give you the most advanced metalworking products but are available to help you solve special metalworking problems. They help make your job easier.
Standard's large, modern refineries produce and assure consistent high quality.

2 *Sold by trained metalworking specialists*

Standard's metalworking specialists bring you the benefits of special training in Standard's own Engineering School and a wealth of job experience. One of these men has headquarters near your plant. He will work closely with you, give you the help you need when you need it, to make your job easier.

3 *Supplied on schedule from nearby warehouses*

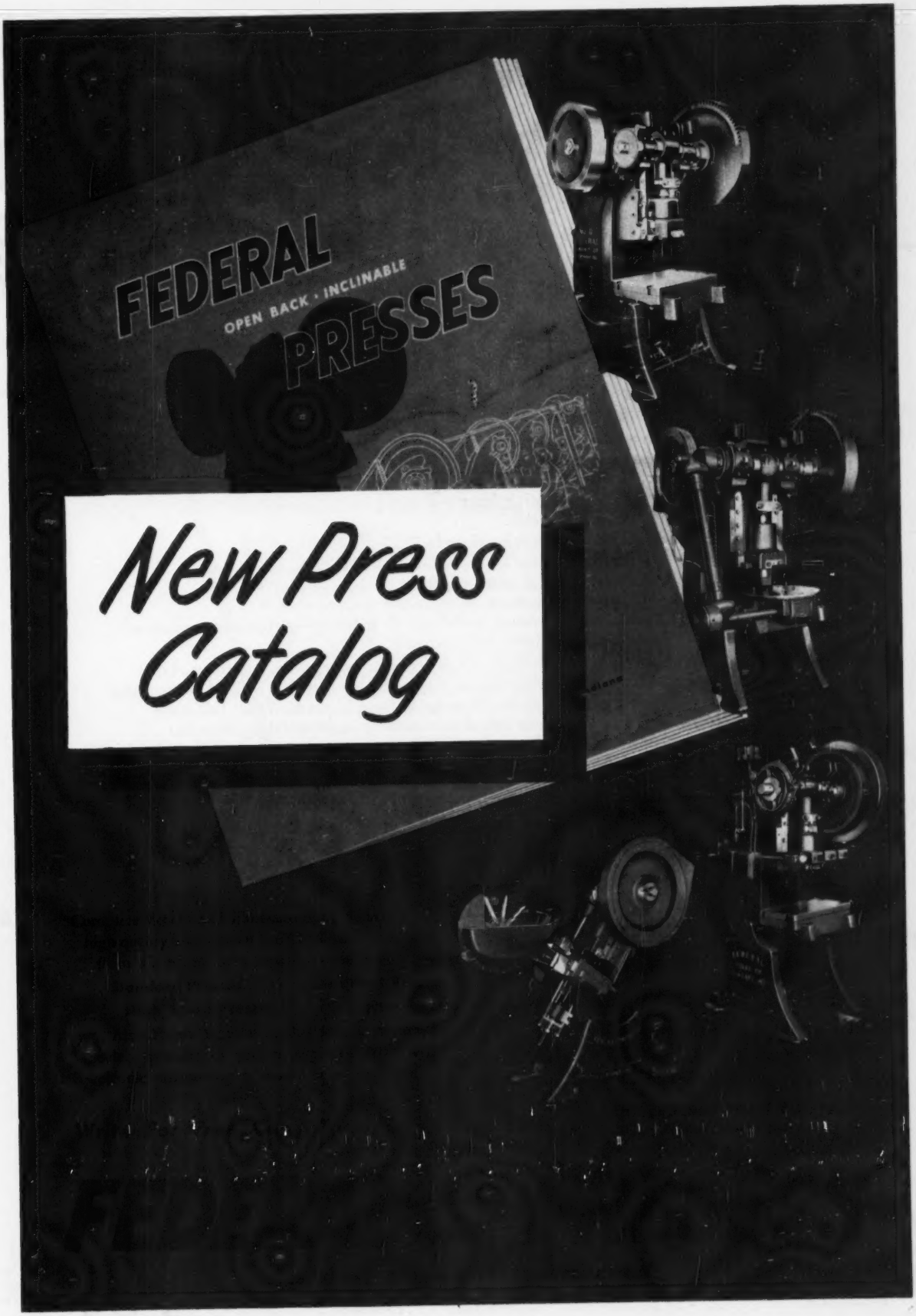
Wherever you are in the Midwest, there's a Standard warehouse and office right in your own backyard! Adequate stocks of the metalworking products you need are near at hand . . . no need to stockpile oils in your plant . . . no need to worry about delivery delays. A local phone call brings you the product you need, delivered promptly to your plant. It helps make your job easier and operation in your plant more efficient.

Call your nearby Standard Oil metalworking specialist

Put Standard Oil's personalized metalworking service to work for you. Phone your local Standard Oil (Indiana) office.

STANDARD OIL COMPANY

STANDARD (Indiana)


FEDERAL
OPEN BACK · INCLINABLE
PRESSES
New Press
Catalog

"WHY DON'T YOU TRY AETNA? YOU'LL BE SURPRISED AT THEIR VERSATILITY"

Yes, Aetna *is* versatile. For 37 years Aetna has been making original equipment bearings and precision parts for the nation's leading manufacturers in the automotive, farm implement and general industrial fields.

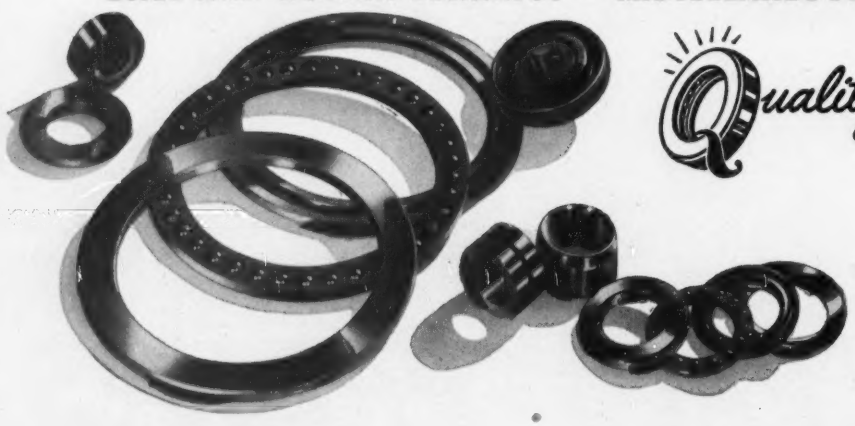
From conventional light duty thrust bearings in 1916, Aetna's versatility has grown to include all-type-all-duty ball thrust bearings, roller bearings and vital parts spanning an incredible range of industrial applications.

It's worth remembering—Aetna's diversified usefulness to industry—Aetna's reputation of producing to the stiffest tolerances known to the industry.

If you are having bearing or parts troubles—if you need a more versatile, more dependable supplier, consider Aetna. Your satisfaction is assured by the fact that 80% of our business comes from firms we have served for 20 or more of our 37 years. Write! Just state your problem, send your prints, or ask that a near-by representative drop in. No obligation. Aetna Ball and Roller Bearing Company, 4600 Schubert Avenue, Chicago 39, Illinois.

Aetna

BALL AND ROLLER BEARINGS • MISCELLANEOUS PRECISION PARTS



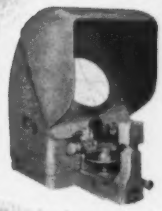
Quality since 1916

BRANCH OFFICES COAST-TO-COAST: • Albany • Atlanta • Auburn • Baltimore • Binghamton • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Denver • Detroit • Hartford • Houston • Jacksonville • Los Angeles • Newark • New York • Niagara Falls • Philadelphia • Pittsburgh • Providence • Richmond • Rochester • San Francisco • Seattle • Syracuse • Trenton • Utica • Waterbury • Worcester. *See your classified phone directory for addresses.*

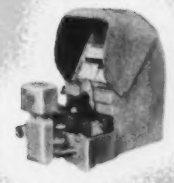
11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models



Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

JONES & LAMSON OPTICAL COMPARATORS

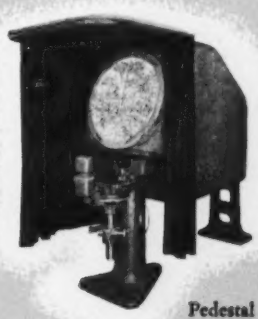
The Essence of Quality Control

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen

Direct
Projection
Type



Pedestal Type
30" Diam. Screen

A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

J&L COMPARATOR DIV.
Dept. 710

Jones & Lamson Machine Company
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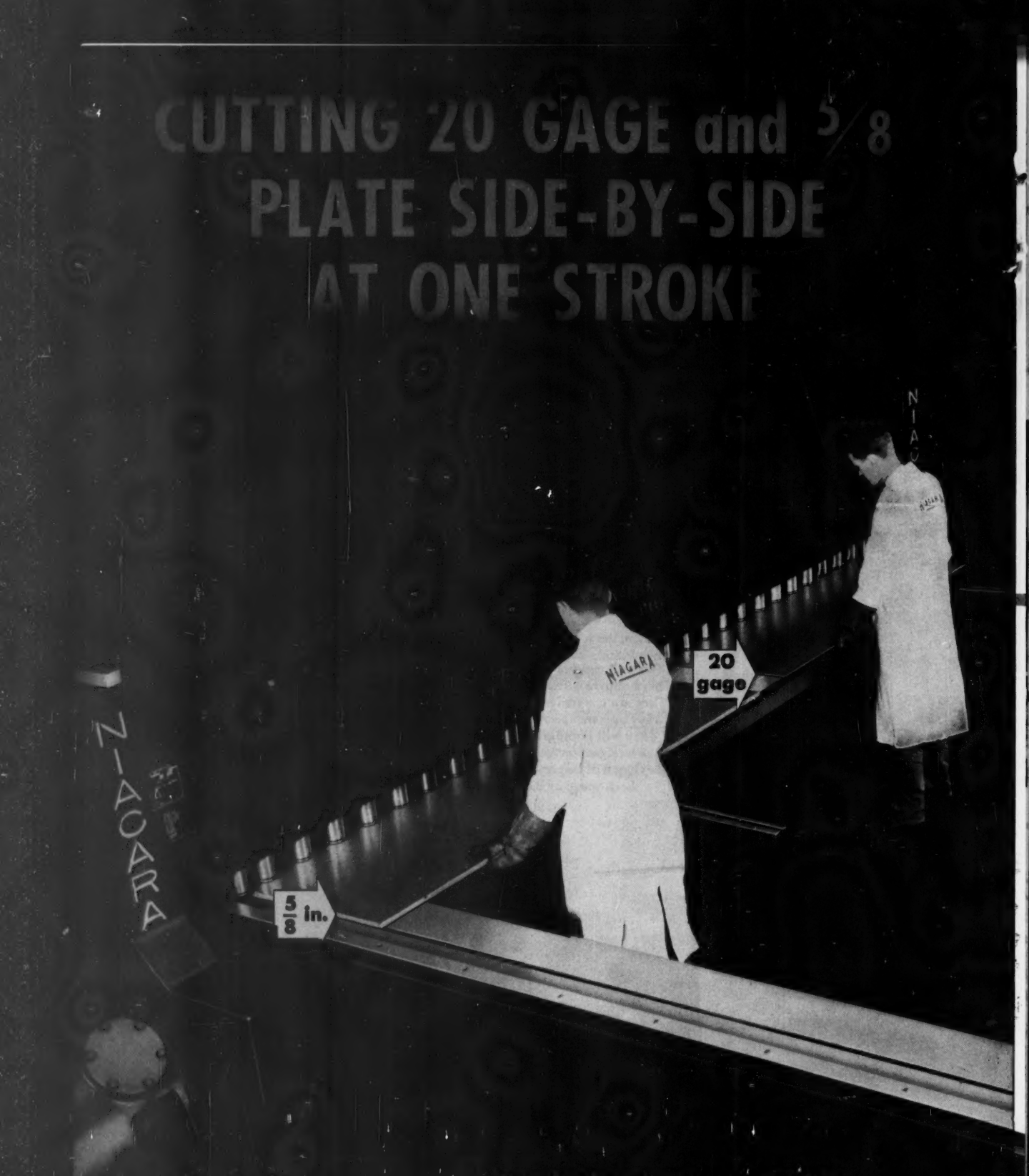
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____



Photograph shows operators cutting ⅝" plate and 20 gage sheet steel simultaneously on NIAGARA Power Squaring Shear. No change in knife adjustment is necessary.

The ability of Niagara Power Squaring Shears to cut thick and thin plate both at the same time with the same knife setting is a dramatic demonstration. Visitors at our plant can see this done every day. There is no necessity for tinkering with the knife adjustment.

Demonstrates the Sound Engineering Design of

NIAGARA

POWER SQUARING SHEARS

● There is no compromise with sound, proven engineering when it comes to NIAGARA shear design and construction.

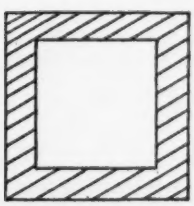
Accurate cutting depends primarily on rigidity of the shear's components.

For bed, crosshead and holddown NIAGARA uses CLOSED BOX SECTIONS to resist with minimum deflection the horizontal, vertical and diagonal or torsional loads to which every shear is subjected.

NO OTHER SECTION WILL DO THIS JOB AS EFFICIENTLY.

Angle or channel shaped sections have long since been abandoned for use on NIAGARA Power Shears.

The economy of quality is remembered long after price is forgotten.



BED, CROSSHEAD & HOLDDOWN DESIGN

NIAGARA MACHINE AND TOOL WORKS, BUFFALO 11, NEW YORK

DISTRICT OFFICES: DETROIT, CLEVELAND, NEW YORK

HOW VERSATILE CAN YOU GET?

P-L-E-N-T-Y... with MEYER, ROTH & PASTOR'S WIRE AND STRIP FORMING MACHINE

UNIVERSAL...

AUTOMATIC...

MULTI-SLIDE...

MEYER, ROTH & PASTOR'S machines mass-produce these and many other parts.

- 5 different size machines for fully automatic, economical production of parts from wire coil or strip stock.
- Various sizes produce from 60 to 300 pieces per minute in wire up to .145" diameter or strips up to 25/32" wide.
- Simplified tooling—machine can be quickly re-set to produce different parts.
- Vertical design takes up little floor space.
- Positive and direct control of the bending slides insures high output and trouble-free operation.
- Roller straightening attachment (7 vertical and 7 horizontal rollers) can be opened—you can feed material without disturbing the roller setting.
- Special gripping device insures uniform feed and does not mark wires or strips.
- 3-speed drive.
- Standard equipment includes 4 forming and 1 punching slide and a complete set of tooling. Additional forming slides and attachments, including a blanking and punching attachment, can be supplied.

WRITE FOR BULLETIN

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

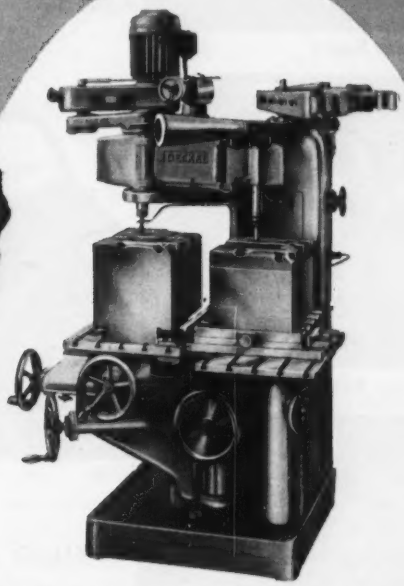
IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

ECONOMICAL, ACCURATE PRODUCTION OF DIES AND MOLDS WITH THE LATEST

DECKEL

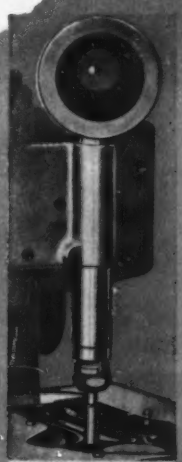
universal pantograph DIE SINKING MACHINE model KF12

Deckel die sinking machines are justly famous for their accuracy, production rate, and ease of operation. The KF12, latest and largest Deckel model, does heavy die-sinking jobs which formerly required much greater investment in equipment. Spindle speeds from 60 to 10,000 r.p.m. enable you to do rough and finish milling, as well as light engraving, on the same machine. The newly developed, "mirror image" milling attachment produces right and left hand dies and molds from the same pattern. Other important features are illustrated below.



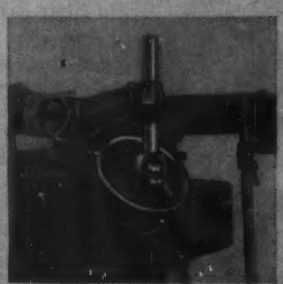
Deckel KF12 makes rapid, accurate enlargements or reductions from 1:1.5 to 1:4 as well as 1:1 duplication. The cutting tool covers an area up to 15¾" x 15¾" or up to 10" x 19¾".

Optical contacting device makes rough milling faster, more accurate. And, accurate rough milling reduces time for finishing.



Saddle elevating motor rapidly raises or lowers master and workpiece at the same time.

Circular forming attachment permits generating spherical shapes.



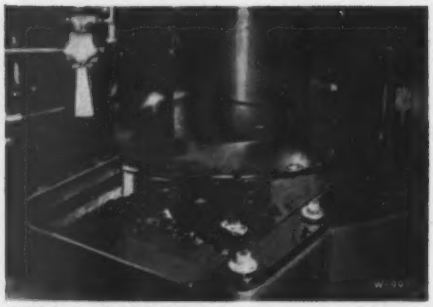
Get in touch with us soon for information on this or other Deckel machines:

2-DIMENSIONAL ENGRAVERS • 3-DIMENSIONAL ENGRAVERS
UNIVERSAL MILLERS • UNIVERSAL TOOL & CUTTER GRINDERS

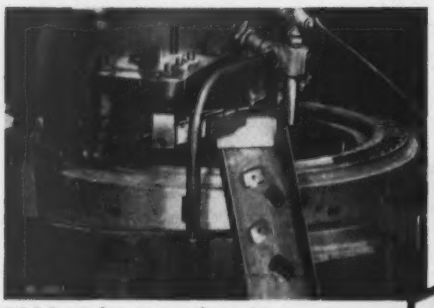
COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools — from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

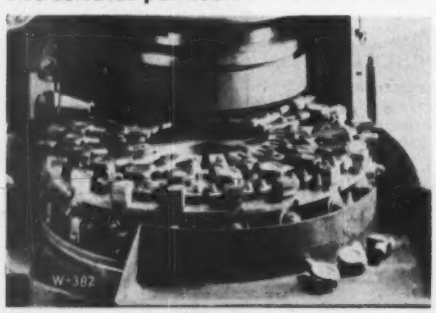


4360 surfaces per hour!



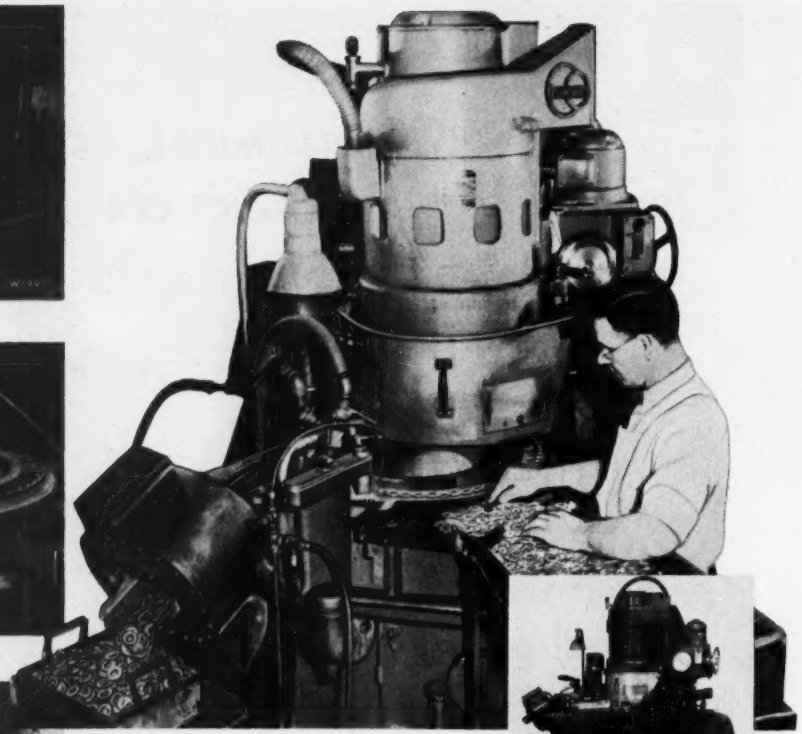
2000 surfaces per hour!

940 surfaces per hour!



900 surfaces per hour!

1400 surfaces per hour!



FIELD REPORT:

... a Blanchard No. 16-A Surface Grinder saved them $39,000 in 2½ years! (cost approx. $12,500) Their order follows for a Blanchard No. 16-A2!

Here's proof of performance and proof of satisfaction, yet typical of what users expect *and get* from the Blanchard 16-A Surface Grinder. Several typical examples of production rates are shown here. Above, for instance, .003" of stock is being removed from one side of small gears to a tolerance of ±.001" *at a rate of 2100 per hour!* This machine has a 30" chuck and a Blanchard Demagnetizer.

The No. 16-A grinds continuously with a wheel that is set and automatically maintained at a fixed height above chuck face, and finishes one surface of the work to size in one pass under wheel. Operator has only to load the work on the magnetic chuck or in an automatic clamping fixture. A wheel control automatically feeds the head down to compensate for wheel wear. Unloading is usually automatic. Attachments can be supplied for demagnetizing and washing the work as it leaves the grinder. On most work, limits of ±.0005" are readily maintained.

The No. 16-A2 (not shown) has two wheels, each with automatic size control. It roughs and finishes one surface of the work in one pass through the machine.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE CO.

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

We've put a new roof over an old part of our business

Now—with new, expanded facilities—we can offer you immediate help with your unusual metalworking problems, big or small

THOUGH we've been designing and building standard and special machine tools and tooling since 1898, limited production facilities for special machines have prevented us from offering these services on a wide scale.

But now, our Special Machinery Division has new and greatly expanded facilities. Its exclusive job will be to build special machine tools and tooling or to specially adapt standard equipment to solve specific metalworking problems.

Check our qualifications:

EXPERIENCE: We've been in the business 55 years. In addition to being one of the country's leading producers of standard milling machines . . . *our annual production of special machinery has ranged up to $3,000,000.*

FACILITIES: The new Special Machinery Division plant, built on a 38-acre site, is equipped with more than *$2,500,000 worth of new tools and equipment.*

PERSONNEL: The Special Machinery Division engineering section has nearly 100 experienced design and production engineers at its command. These men specialize in applying the latest developments in mechanics, hydraulics, electronics, metallurgy and allied fields to metalworking. In addition, it has a full complement of experienced machinists and mechanics needed for special machine construction.

PERFORMANCE: Kearney & Trecker's Special Machinery Division is best recommended by its record of successfully solving hundreds of unusual machining problems. These solutions required provision of high productive capacity as well as exacting dimensional accuracies and surface finishes.

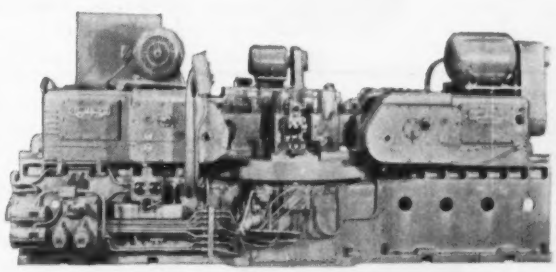
RESPONSIBILITY: Our Special Machinery Division is an integral part of the Kearney & Trecker Corporation . . . and is fully supported by all its financial, physical and personnel resources.

Any commitment for a product of this Division is a commitment that fully involves the accepted reputation for responsibility and satisfaction that is Kearney & Trecker's.

We invite your inquiry

We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

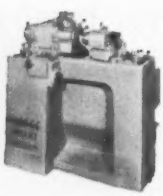
Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a four-station rotary indexing machine we designed and built for a major automotive manufacturer.

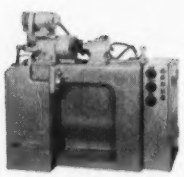
KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS ®

bryant
internal grinding



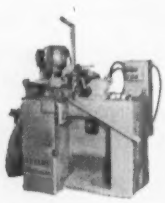
no. 1309-W

Finishes 2 bores and a taper straight and concentric. 2 wheelheads are used on this semi-automatic. Max. traverse stroke, 6". Max. grinding length, 3½".



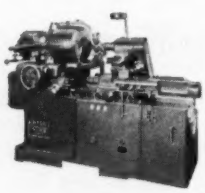
no. 1109

For high production of small bores where accuracy of size and finish are required. Max. traverse stroke, 6". Max. grinding length, 3½".



no. 2209

For precision and high production grinding of ball bearing races, gears, rolls, bushings, etc. Max. traverse stroke, 6". Max. grinding length, ¾".

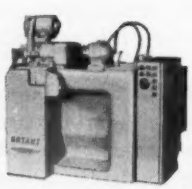


no. 1116

A general purpose hole grinder for tool room, small shop, or general production. Maximum traverse stroke, 20". Maximum grinding length, 8".

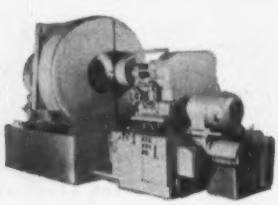
no. 1416

Specially designed for grinding bores in long work, such as machine tool spindles. Maximum traverse stroke, 20". Maximum grinding length, 8".



no. 1209

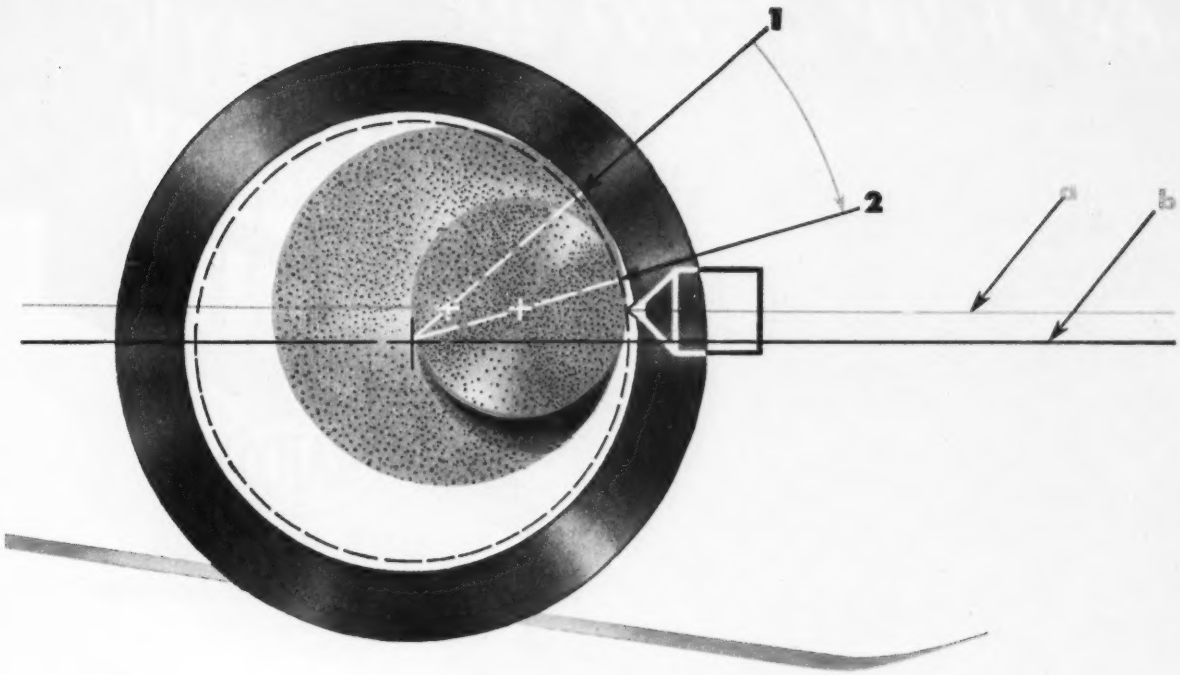
A fully automatic, high production machine for small and medium bore grinding. Max. traverse stroke, 6". Max. grinding length, 3".



no. 1460

For production or single piece hole grinding on parts up to 60" diameter. Max. traverse stroke, 21". Max. grinding length, 16".

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.



IF the internal grinder is to generate straight holes within precision tolerances, on a production basis, the various elements of the machine must be properly aligned. The axis of the work, the axis of the wheel, and the diamond must be in a plane parallel with both traverse and cross feed ways. Then the direction of feed will coincide with the line from the center of the workpiece to the point of contact between the wheel and the work, and the wheel will be dressed in line with its point of contact with the work regardless of the size of the wheel.

In the illustration above, these requirements are not met because the work center "b" is below plane "a" established by the wheel axis and the diamond. The drawing shows the wheel at its largest diameter (new) and also at its smallest diameter (worn). The difference between center heights "a" and "b" is constant during the life of the wheel. The position of the diamond remains constant for the life of the wheel. When the large wheel is dressed by the diamond it will contact the work at a point established by a line from the center of the work through the center of the wheel (position 1). When diamond sizing, the work, or wheel, is fed to a predetermined position. As the wheel wears down, it will continue to contact the diamond at the same point during dressing, but the small wheel will contact the work at position 2 and the size of the finished hole will be substantially smaller.

As the wheel wears, the point of contact between wheel and work will move gradually from position 1 down to position 2, and the size of the finished hole will become progressively smaller. This is one of the reasons that some internal grinders, when set up for diamond sizing, will not hold size during the life of the wheel. Many operators attempt to compensate for this error by constantly adjusting the diamond. The correct remedy would be to bring the axis of the work, the axis of the wheel and the diamond all into a common plane parallel with both traverse and cross feed ways. Finish size will then be correct regardless of wheel diameter.

Bryant Chucking Grinder Company
Springfield, Vermont, U. S. A.

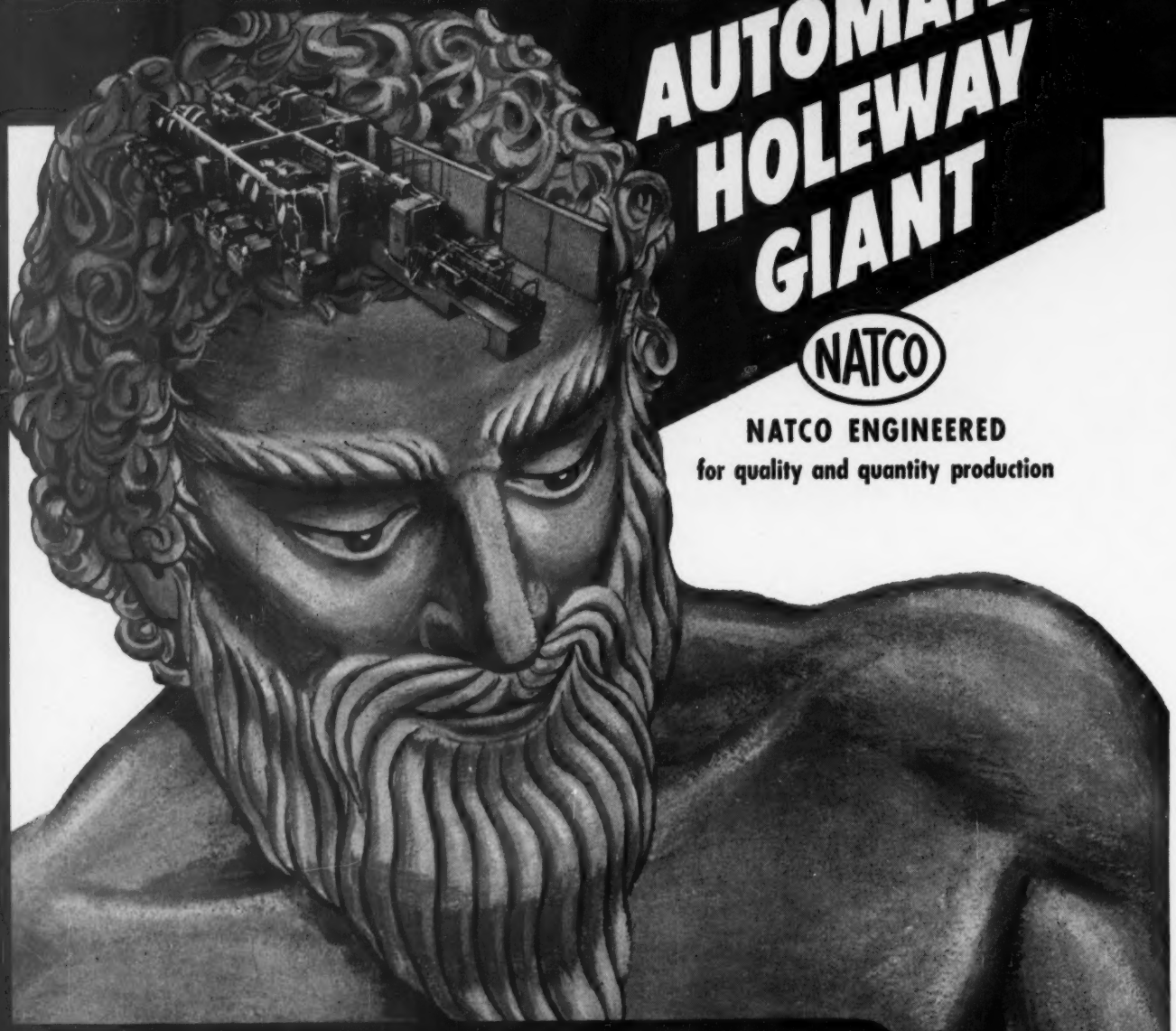
Internal grinders • Internal & External thread gages

See how another

AUTOMATIC HOLEWAY GIANT

NATCO

NATCO ENGINEERED
for quality and quantity production

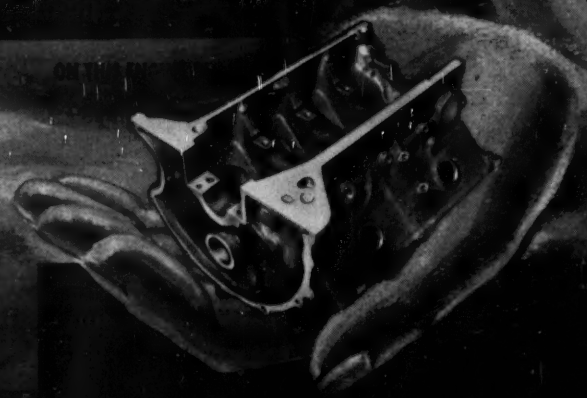


Completes all 55 operations

at the rate of nearly

parts per minute

drilling, combination core
and chamfering, reaming, combination
facing and chamfering, combination rough
and tool facing, rotating part 180°



PRODUCES 111 PARTS PER HOUR and inspects its own production

OPERATIONS

STATION #1 Load 1 part

STATION #2

Right Angular Head (17° above horizontal)
- Drill 1 hole #74 to 7/16" diameter part depth.
- Drill 3 holes #73, #75 and #77 to 7/16" diameter part depth.
- Drill 1 hole #76 to 31/32" diameter part depth.

STATION #3

Right Angular Head (17° above horizontal)
- Drill 1 hole #74 to 7/16" diameter additional part depth.
- Drill 3 holes #73, #75 and #77 to 7/16" additional part depth.
- Drill 1 hole #76 to 7/16" diameter additional part depth.

STATION #4 Idle

STATION #5

Left Angular Head (45° above horizontal)
- Combination core drill and chamfer 2 holes #80 and #81 1-23/32" dia. for 1.750" ream.
- Drill 2 holes #82 and #83 to 3/8" diameter for 7/16" x 14 tap.
- Drill 1 hole #84 to 7/16" dia. through for 1/4 NPSF Thread.

Right Angular Head (45° above horizontal)
- Combination core drill and chamfer 2 holes #85 and #86 to 1-23/32" dia. for 1.750" ream.
- Drill 2 holes #87 and #88 to 3/8" diameter for 7/16" x 14 tap.

STATION #6

Left Angular Head (45° above horizontal)
- Ream 2 holes #80 and #81 to 1.750" diameter. Combination spot face and chamfer 2 holes #82 and #83 to size.

Right Angular Head (45° above horizontal)
- Ream 2 holes #85 and #86 to 1.750" diameter. Combination spot face and chamfer 2 holes #87 and #88 to size.

STATION #7 Idle

STATION #8

Left Angular Head (angle off vertical)
- Drill 1 hole #34 to 1/4" diameter 1/2 depth.

Right Angular Head (17° above horizontal)
- Combination rough counterbore for 4.94" finish diameter and spot face 1-15/16" dia. bolt boss #76.

STATION #9

Left Angular Head (angle off vertical)
- Drill 1 hole #34 to 1/4" diameter through.

Right Angular Head (17° above horizontal)
- Finish counterbore 1 hole #76 to 4.94" diameter.

STATION #10 Idle

STATION #11

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter additional part depth.
- Drill 1 hole #76 to 11/32" diameter additional part depth.
- Drill 1 hole #78 to 11/16" diameter .24" deep.

STATION #12

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter additional part depth.
- Drill 1 hole #76 to 11/32" diameter additional part depth.
- Drill 1 hole #78 to 9/16" diameter .46" depth.

STATION #13 Idle

STATION #14

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter to depth.
- Drill 1 hole #76 to 11/32" diameter to depth.

STATION #15

Right Vertical Head
- Mill 4" dia. seat around hole for oil breather tube.

STATION #16 Idle

STATION #17
- Rotate part 180°, vibrate while rotating from pan face up to pan face down front end leading.

STATION #18

Left Side (17° below horizontal).
- Inspect holes to be tapped for drill through and depth 5 holes #73 to #77 incl. (45° below horizontal).
- Inspect holes to be tapped for drill through and depth—2 holes #87 and #88.

Right Side (45° below horizontal)
- Inspect holes to be tapped for drill through and depth 3 holes #82, #83 and #84.

STATION #19 Unload
- Oil pan face down front end leading.

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping.

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NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

1809 Engineering Bldg., CHICAGO • 409 New Center Bldg., DETROIT
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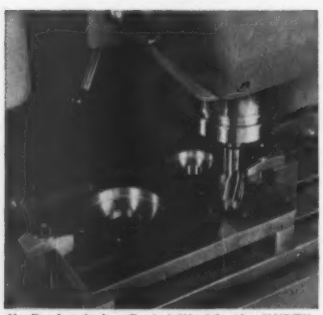
Boring operation on 24" aluminum microwave component. Note complicated set up made simple with HURTH tiltable worktable. Deep throat of machine saves set up time . . . saves cutters, too.

PHOTOGRAPHED AT L. H. TERPENING CO.

can you match these savings...in your boring and milling operations?



Jig Boring holes first drilled in the HURTH.

End milling stainless steel block to .001".

65% saving in set up and production time at RAYTHEON

"The HURTH V10a performs both jig boring and milling operations that would cost us three times as much on other type equipment. We find it flexible for short runs and equally reliable and consistent for long runs."

says Albert Waldstein, Mgr., Machine Design and Fabrication, RAYTHEON MANUFACTURING CO.

25-50% saving in toolroom and small lot production at TERPENING

"The HURTH V10a cut our jig boring and milling time up to 50% compared to equipment formerly used. It's the first machine we turn to for close-limit tooling and small lot production and it does work not possible on our other machines. In jig boring with the HURTH, we locate and size holes within .0002"."

says E. J. Friebele, Chief Engineer, L. H. TERPENING CO.

Both agree – as do all other HURTH users – that there's no precision tool so economical to run when complicated set ups with many tool changes are required. For the HURTH combines vertical milling, downfeed milling and jig boring in one machine – performs these *three different operations* to close tolerances with *one* set up of the work. You merely change table settings and cutting tools for:

VERTICAL MILLING – using longitudinal traverse of work table, which can be tilted 15° to front or rear.

DOWNFEED MILLING – using longitudinal traverse of worktable and graduated downfeed of cutting spindle.

JIG BORING – using continuous spindle downfeed, varied in extremely small steps.

Match the savings other HURTH users are getting – in your toolroom – on your production line. Talk it over with one of our sales engineers. Write for details.

Delivery from stock. Engineered servicing and stock parts from Orban Service Centers.

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KURT ORBAN

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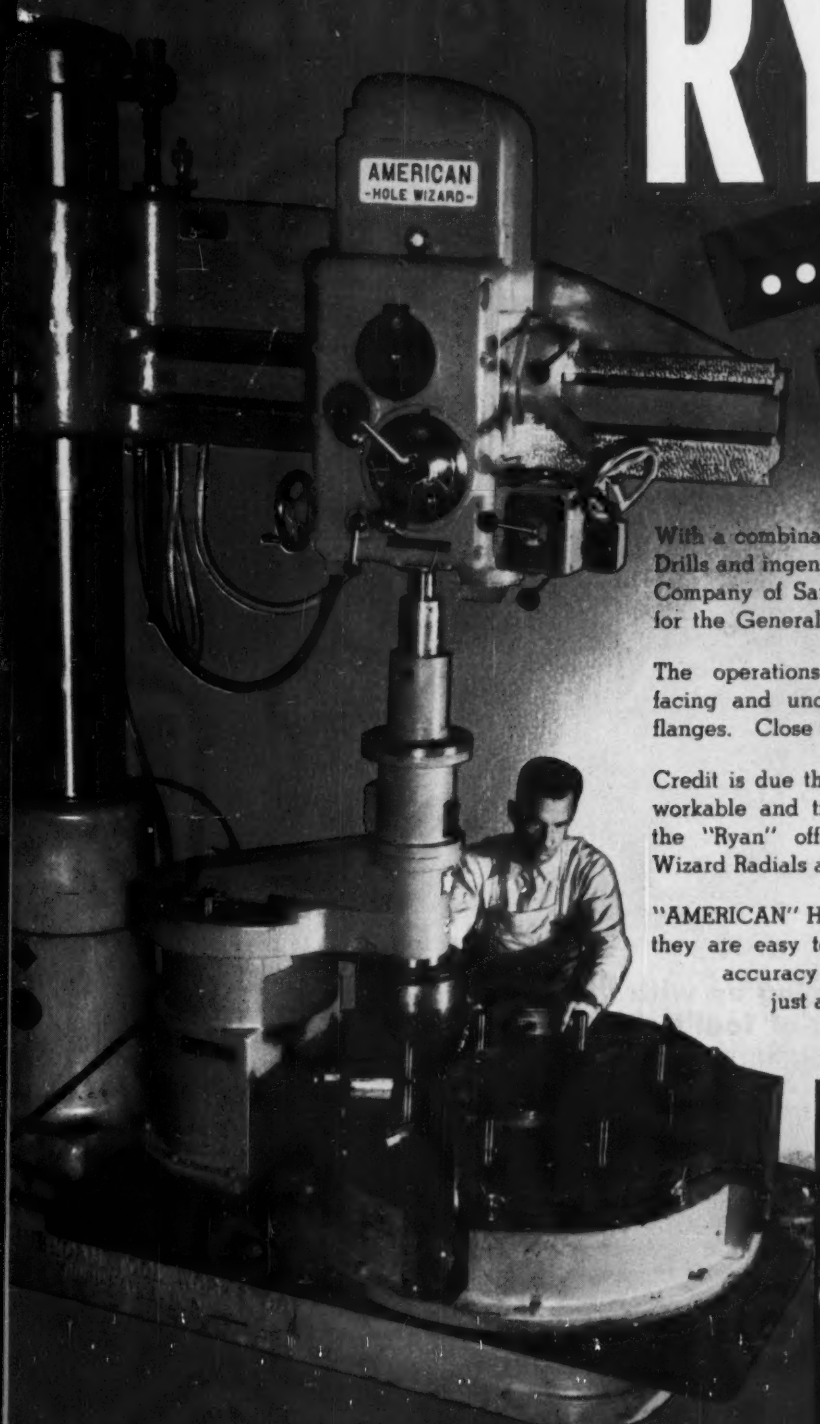
RYAN ...HITS THE JACKPOT!

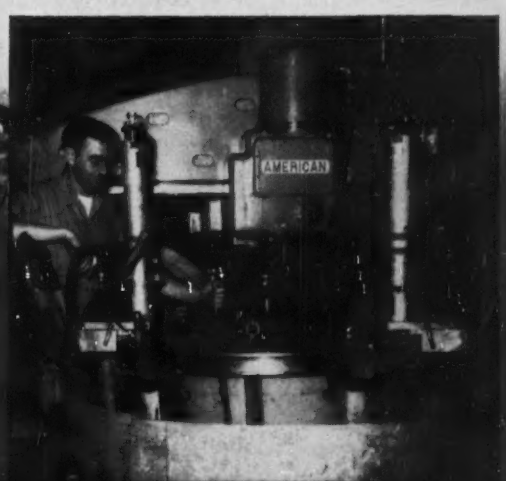


With a combination of "AMERICAN" Hole Wizard Radial Drills and ingeniously designed fixtures Ryan Aeronautical Company of San Diego, California, produces Aft Frames for the General Electric J-47 jet engine in record time.

The operations performed include precision boring, facing and undercutting of the stainless steel support flanges. Close tolerances must be and *are* held.

Credit is due the "Ryan" engineers for developing such workable and time saving fixtures. Credit is also due the "Ryan" officials for selecting "AMERICAN" Hole Wizard Radials as part of the "winning combination."

"AMERICAN" Hole Wizards are sturdy; they are powerful; they are easy to operate and they retain their original accuracy for years to come. For substantiation just ask the operator.

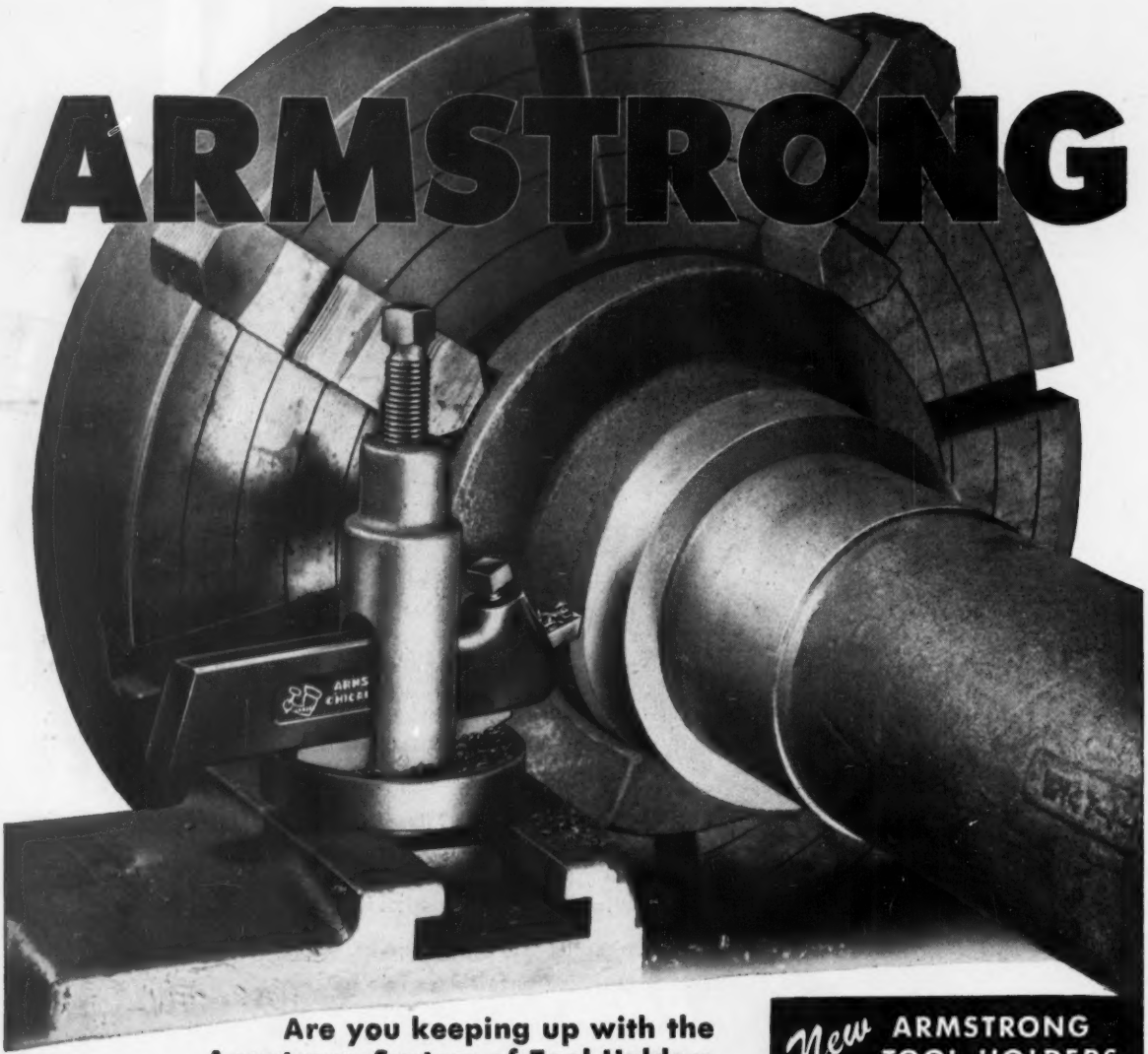


Bulletin No. 316
will give you the facts

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

ARMSTRONG



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

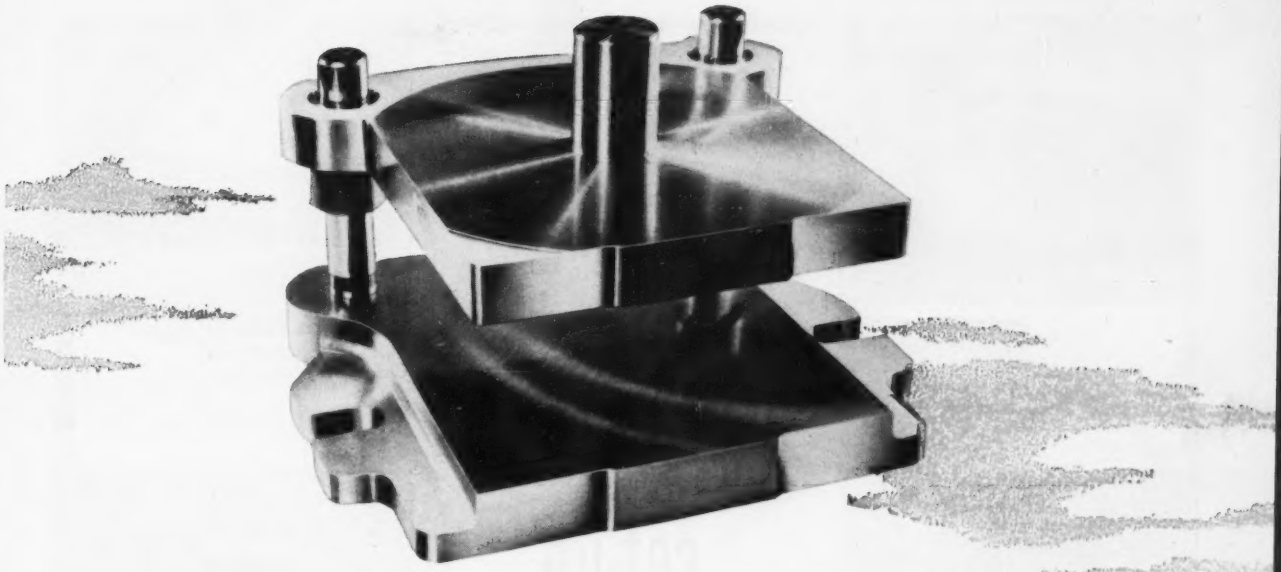
With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

WRITE FOR CATALOG

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.



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help build the mighty Cat Diesel Tractor

You can trace the mountain-moving brawn of the famous Cat-built Tractors right back to the production line . . . and to Danly Die Sets. Caterpillar Tractor Co. uses Danly Die Sets as a precision base for many diemaking operations . . . depends on them to help maintain uninterrupted production schedules. Danly Die Sets save countless hours in the die shop . . . make tooling-up much faster – easier too. Why not bring Danly Die Sets into your production picture? . . . get the kind of die performance you're looking for. Remember – there's a Danly Branch near you. Service is fast . . . convenient.

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2100 South Laramie Avenue, Chicago 50, Illinois

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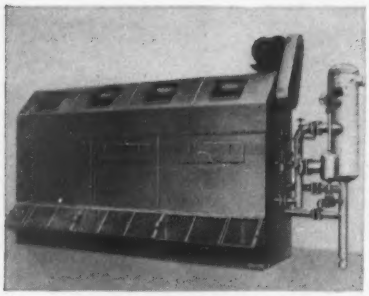

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York Corporation
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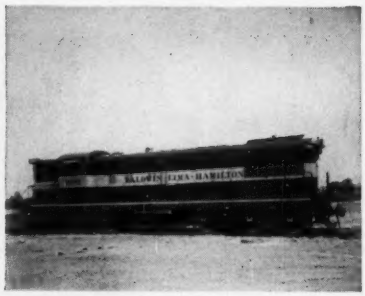

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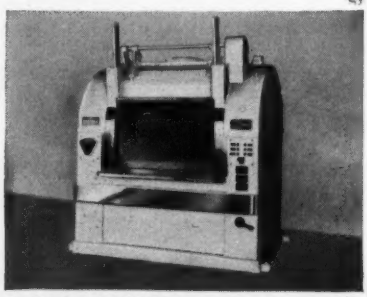

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INDUSTRIAL TRUCKS
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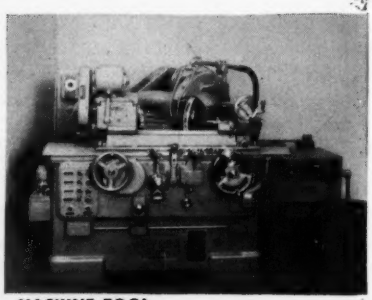

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These are just a few who do!

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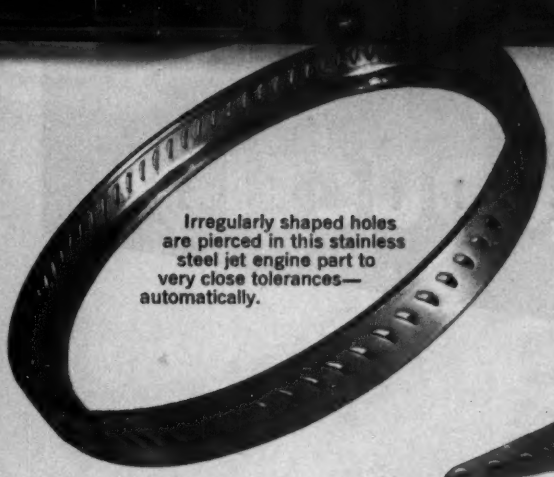
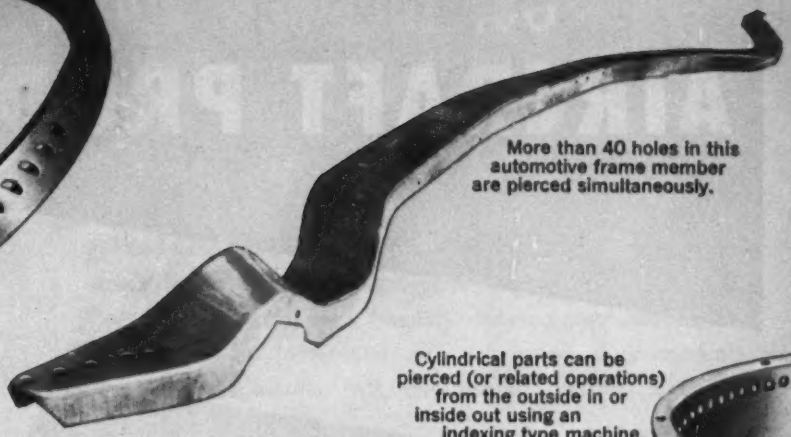
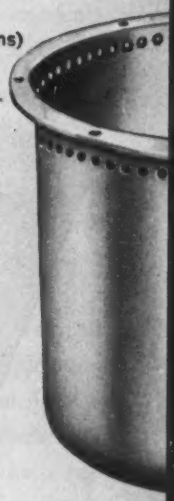


Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.



More than 40 holes in this automotive frame member are pierced simultaneously.

Cylindrical parts can be pierced (or related operations) from the outside in or inside out using an indexing type machine.



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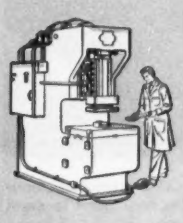
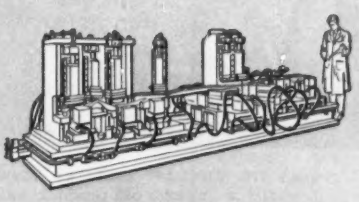
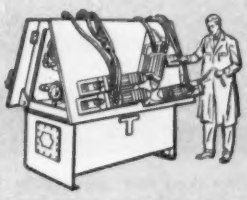


General Purpose Gap Frame Piercing Press



Automotive Frame Piercing Machine



Automotive Inner Window Frame Piercing Machine

Jet Engine Shroud Ring Piercing Machine

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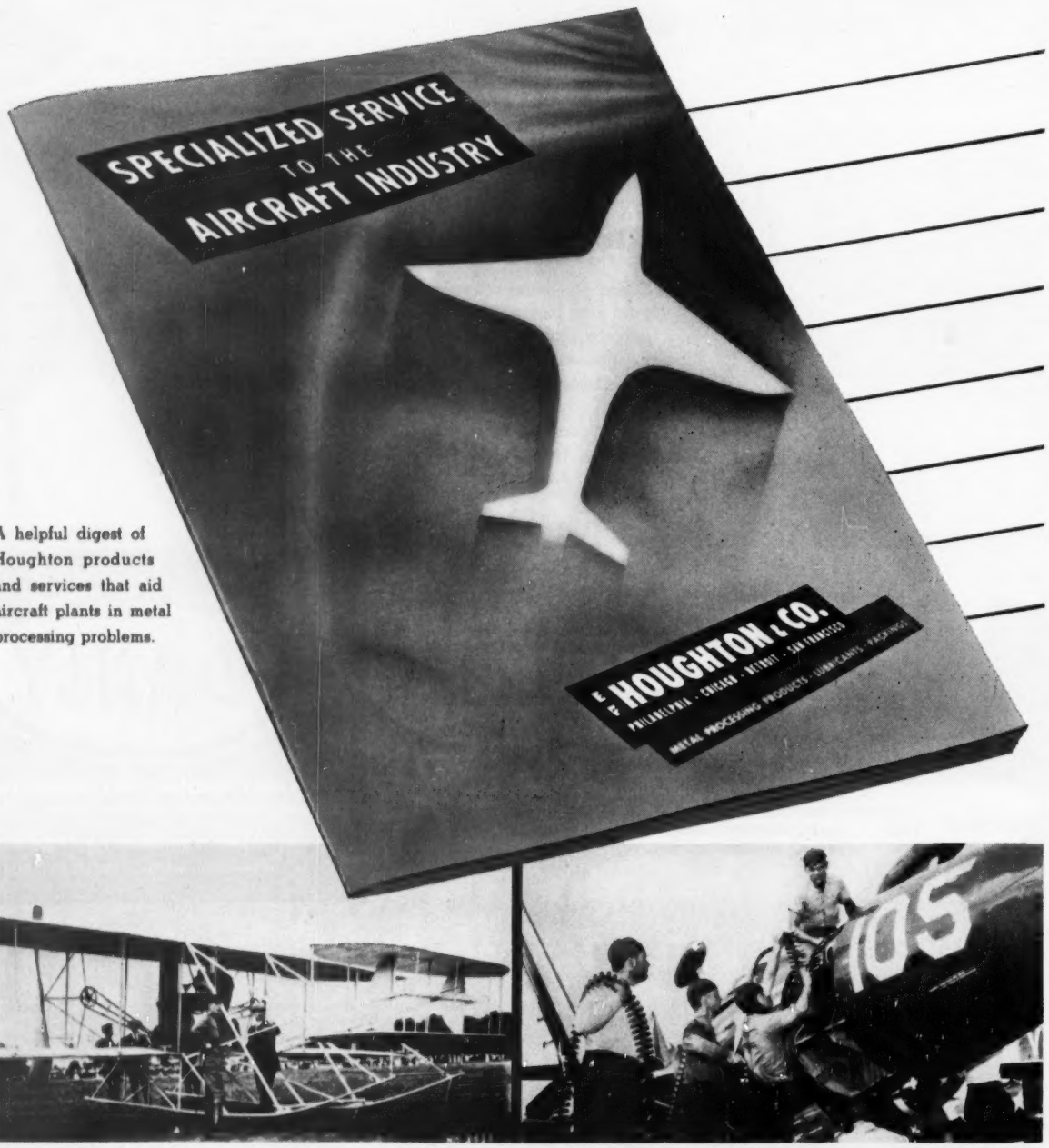
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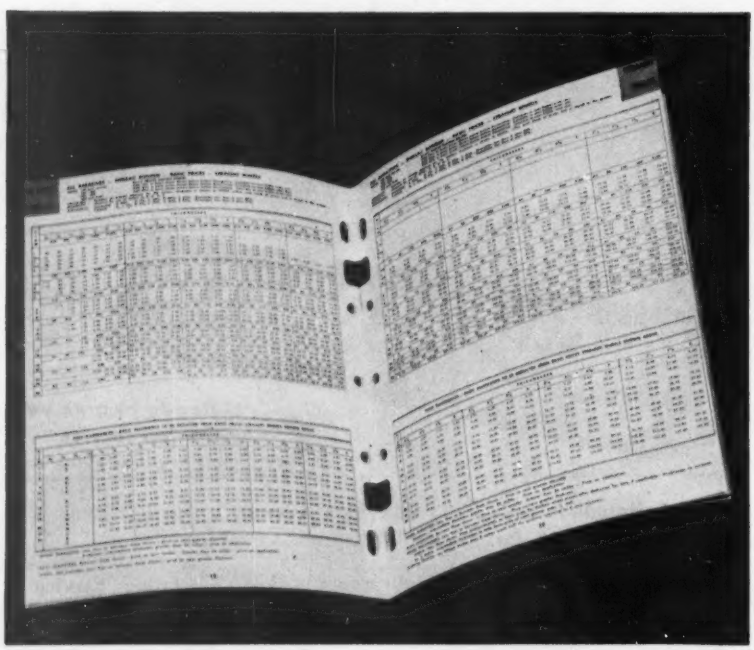


114 Page Pricing System Now Simplified to 32 Pages

CARBORUNDUM has achieved *simplification* with this new basic pricing system: previous information requiring 114 pages covering list prices, discounts, etc., has been reduced to only 32 pages.

You can now order your grinding wheels from CARBORUNDUM with a speed and accuracy hitherto impossible. Practically everything you want to know about prices, ordering quantities, discounts on any one wheel will be found on one page—arranged for quick, easy finding.

CARBORUNDUM® has taken the mystery out of buying industrial grinding wheels...by adopting the first really simplified basic price system in the history of the industry. Now you can determine prices, ordering quantities and discounts for a given wheel, almost without exception, by checking a single page of this new book.

You no longer have to refer to several pages to determine prices and discounts, nor follow complicated rules, nor apply chain discounts, nor worry about decimal multipliers. Even the special price additions covering various shapes have been eliminated. Basic prices are shown for all straight wheels *and* special wheels such as dishes, saucers, flaring cups, special faces, cones, plugs, and many others.

Practically all the wheels you use can be priced with a single discount under this new system, thus further simplifying your paper work and minimizing errors.

Coincidental with the adoption of this basic pricing system, some price adjustments have been made. Prices of certain lines of wheels are reduced, others are slightly higher.

"A Boon to Every Customer and To Us," is Distributor Concensus

First copies of this new pricing system off the press went to several hundred Industrial Distributors of CARBORUNDUM's grinding wheel lines. The many letters of response have been highly enthusiastic. Here are typical comments:

"This is, without a doubt, the finest simplified pricing system I have ever seen. We want to compliment you on this progressive step."

"Heartiest congratulations—the new net pricing schedules are swell! It would do your heart good to see the gratitude with which these prices were received by the boys in our organization. I feel that you men who devoted so much time to getting out this pricing structure should know how we feel. This is a real contribution to Industrial Distributors—and to industrial purchasing agents."

"Next to standardization of gradings, your new price book is probably the most progressive step that has been taken in simplifying the marketing of abrasives. With this new basic pricing plan practically all the complications have been removed. We know it will have enthusiastic reception."

"Carborundum has taken a forward step that should pay off in the future. After trying a few examples in pricing, it looks as though price clerks and purchasing people will have a much easier time arriving at net prices than heretofore."

The success of this new simplified pricing plan was foreordained, because twelve of the nation's top industrial supply men helped put the system together. This group, known as CARBORUNDUM's *Distributor Advisory Board, was of material assistance to* CARBORUNDUM's *sales management on this key project.*

HOW IT SAVES TIME...Cuts Errors

Reducing the number of pricing pages from 114 to 32 gives you only part of the picture of how CARBORUNDUM's new system speeds and simplifies the pricing of grinding wheels. It actually cuts down the number of steps required to compute a price—and best of all, it concentrates those steps within the confines of a single page.

As an example, consider the steps—and separate page references—previously required to find the price of cup wheels: 1) Look up the page showing the list price... 2) Look up the page showing list price additions... 3) Look up the page showing the standard ordering quantity schedule, to determine quantity for discounting purposes ...4) Look up the page showing product discount... 5) Look up the page showing quantity discount.

All this information, previously appearing in five different places in the price schedule, is now found on a single ready-reference page. No wonder pricing now takes far less time, with far fewer chances for error.

For when you have to flip pages back and forth, sometimes losing your place, often doing involved calculations, not only do you waste valuable time, but errors are bound to creep in—errors that are even more costly than the high cost of lost time. This new simplified "all-on-one-page" system was designed to be error-proof; thorough tests by grinding wheel users prove that it actually promotes a high degree of accuracy—thus makes doubly valuable the savings in time it gives you.

Simplified Pricing to be Extended to Other Abrasive Lines

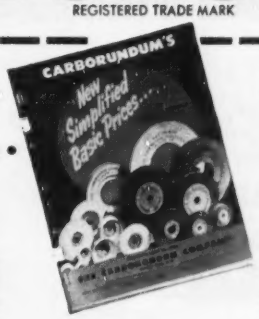
The new basic pricing system will soon be applied to additional abrasive lines by CARBORUNDUM. Segments, Disc Wheels, Mounted Wheels and Points, "MX" Wheels, and other bonded products will shortly be covered by new simplified basic price lists.

THE CARBORUNDUM COMPANY

REGISTERED TRADE MARK

Your copy is waiting for you...

MAIL COUPON NOW...TODAY!



THE CARBORUNDUM COMPANY, Dept. M 81-317
Niagara Falls, New York

Please send me my copy of "New Simplified Basic Prices of Grinding Wheels."

NAME

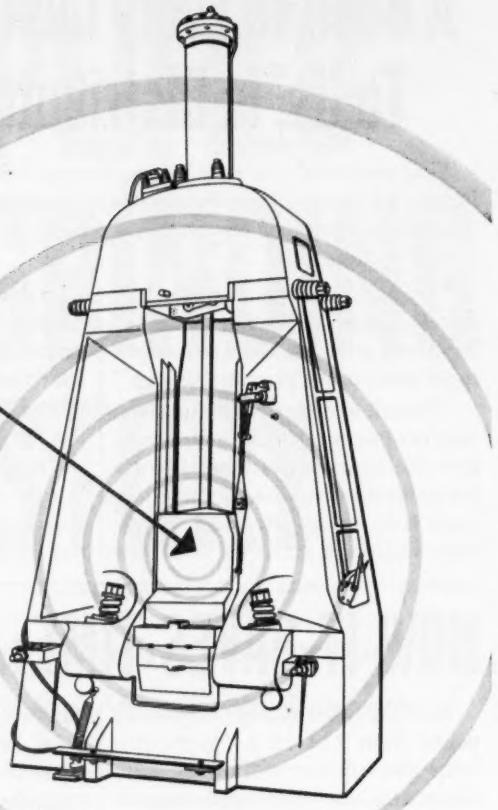
COMPANY

STREET AND NUMBER

CITY ZONE STATE

81-317

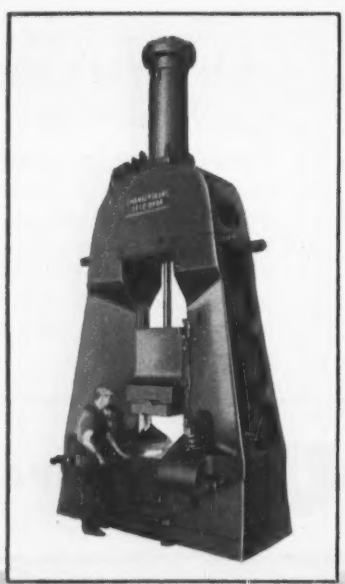
CENTER OF GRAVITY AT POINT OF IMPACT



• • • The center of gravity of the CECO-DROP concentrates the forces toward the base and gives a more effective blow.

• • • The center of gravity of the whole hammer approximates the center of gravity of the ram at the point of impact minimizing the fight between the ram and the other parts of the hammer.

• • • The resultant maintenance of die alignment assures fewer rejects and higher production in comparison with other types of forging hammer. This is an outstanding difference between CECO-DROPS and other hammers.



CECO-DROP PISTON LIFT GRAVITY DROP HAMMERS

are the result of more than a half century of experience in the design and manufacture of hammers. They cost less to operate. There are no board changes, no friction adjustments, and lubrication is automatic. Treadling the Ceco-Drop is easy and not fatiguing, and die alignment is held. The unique stroke adjustment and short stroke control afford a wide range of operation. Ask for our Bulletin 11-L-O.

CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PA.

CHAMBERSBURG

THE HAMMER BUILDERS

Builders of THE IMPACTER

"FORGING IN MID-AIR"

Announcing a new gage that simplifies the measurement of

SURFACE ROUGHNESS

...the

BRUSH SURFINDICATOR*

Manufactured under patent license from General Motors Corporation

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT
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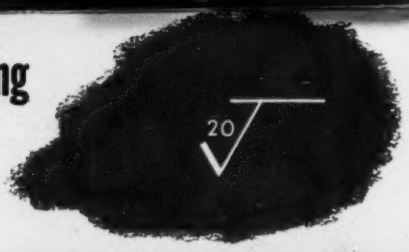
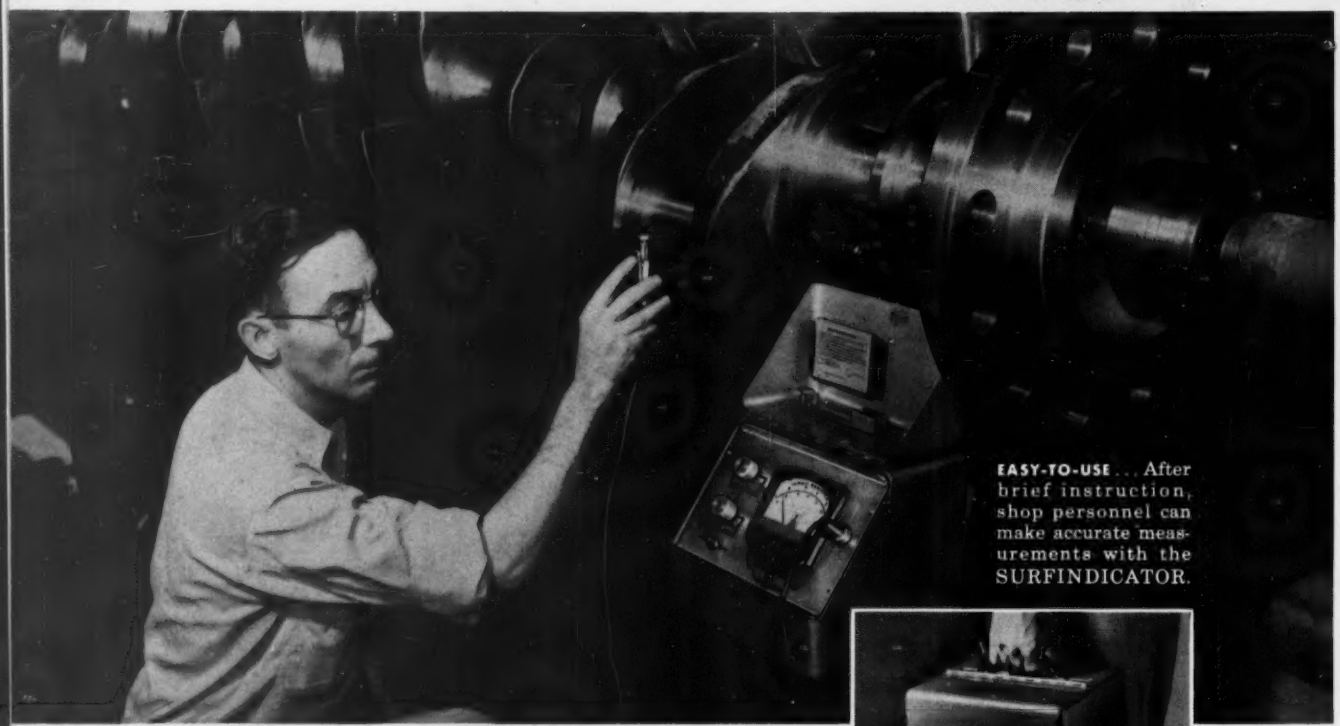
formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

*Trade Mark

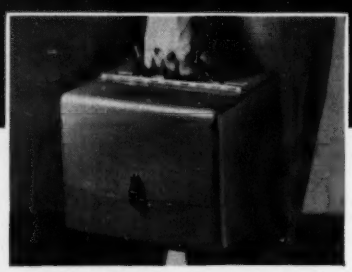
Here is a practical shop tool for measuring

SURFACE ROUGHNESS





EASY-TO-USE . . . After brief instruction, shop personnel can make accurate measurements with the SURFINDICATOR.



PORTABLE...Weighs only 15 pounds and can be set up anywhere in the plant where 115 volts a. c. is available. Completely self-contained.

ACCURATE . . . Precision Reference Specimens permit calibration to an absolute standard, and enable you to check accuracy of instrument at any time.

. . . the BRUSH SURFINDICATOR*

With this new, portable inspection tool you can make surface roughness measurements on the production line. The operator merely guides the pickup over the piece to be inspected, and then reads surface roughness in average microinches on the meter. This permits you to specify surface roughness in the design and then to measure it in the shop.

The SURFINDICATOR is always reliable because the unit is equipped with Precision Reference Specimens. These permit checking accuracy of the instrument at any time, and provide a set of standards for absolute calibration. Using SURFINDICATORS, several plants in different locations can produce parts to the same surface roughness specifications. Here is the instrument that makes surface roughness measurement a practical shop operation. Get the complete story on the BRUSH SURFINDICATOR now!

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14. **BRUSH ELECTRONICS CO.,**
    Cleveland 14, Ohio

*Trade Mark

Brush Electronics Company, Dept. Y-6
3405 Perkins Avenue, Cleveland 14, Ohio

Please send bulletin on the SURFINDICATOR.

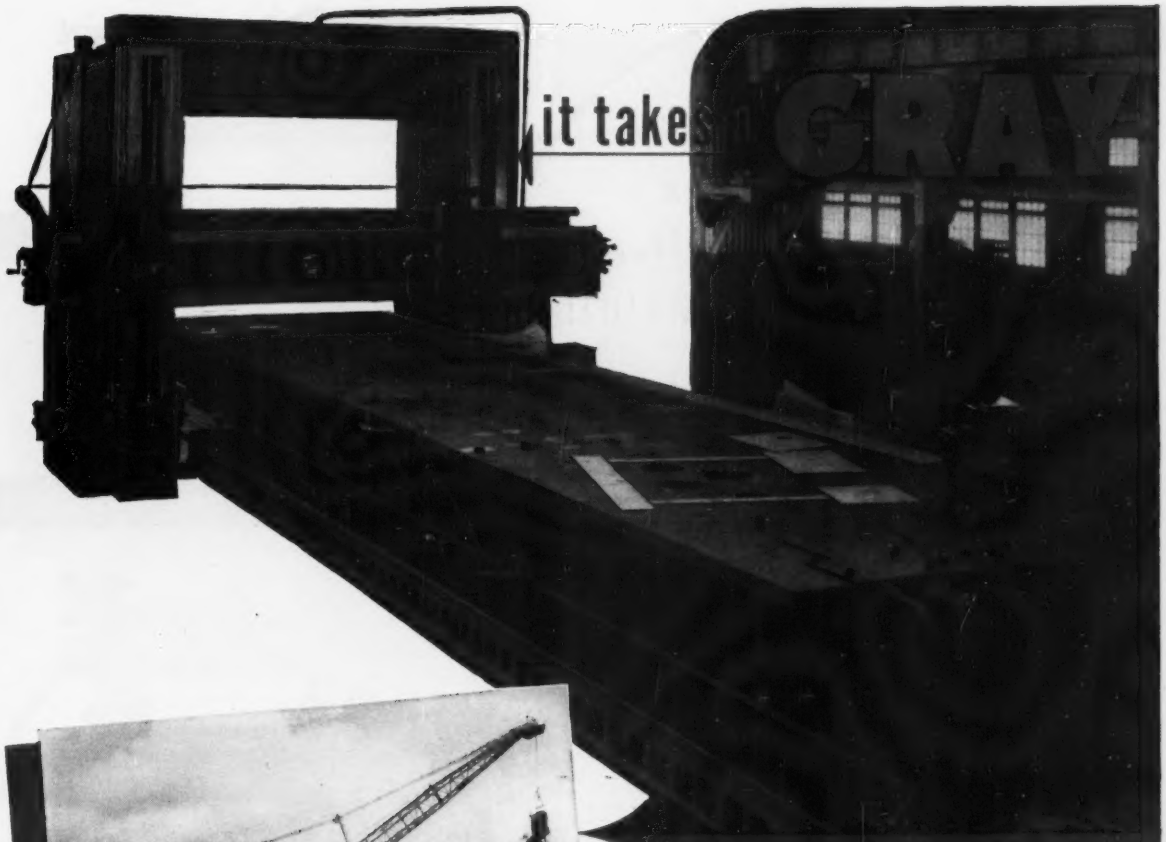
Your name .....

Company .....

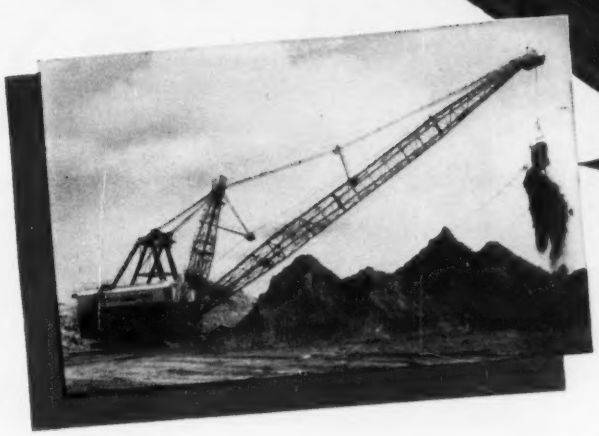
Position .....

Address .....

City ..... State .....



it takes GRAY



to build

GIANTS

that move

MOUNTAINS

Big planers are usually slow planers. But not a GRAY! Bucyrus-Erie found that out when they put a new GRAY 132" x 120" x 50' Heavy Duty Planer to work. This precision GRAY with modern high speeds and operating conveniences is machining a 55' long side section of revolving frame of a Bucyrus-Erie dragline . . . . . a big mouthful in any shop. Again, performance is proving that planer jobs don't grow old on a GRAY.

Write today get the story on **HIGH** low cost **PRODUCTION**

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The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN

hendey lathes are better built...

FOR LONGER, MORE ACCURATE LIFE!

And here's how it's done — Hendey starts with quality design and follows through with quality workmanship. Take the hardened and precision ground bed ways, for instance. Hendey does this differently *and better!* First, the world's most modern induction hardening equipment uniformly hardens the ways. Next, the precision machined legs and chip pan are attached to the bed (and they are never removed thereafter). Ultra precision grinding follows. Exacting checks for accuracy are then followed by electronic testing for hardness — uniform hardness — there are no soft spots in a Hendey bed — and a customer's test sheet proves it!

Add to this, quiet headstocks, the finest of lead screws, simplified, convenient controls and the ruggedness and power essential for modern precision turning.

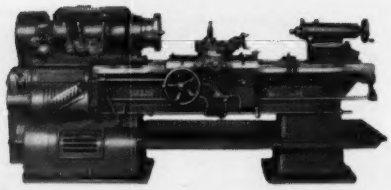
Hendey lathes maintain the Hendey tradition for quality and accuracy. And there is the *right* machine in the Hendey line to suit your precision turning requirements. Write for details.

Featuring uniformly hardened and precision ground bed ways.

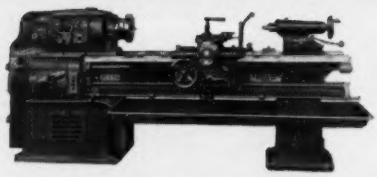
HENDEY

the Hendey machine co., inc.
torrington, conn., u.s.a.
——precision machine tools——

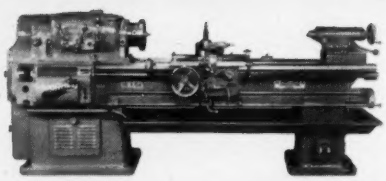
distributors in principal cities



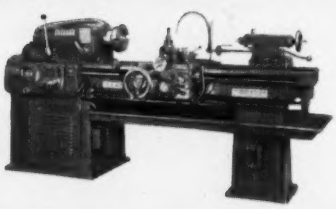
18″ — 20″ — 24″ 12-speed Geared Head Lathes



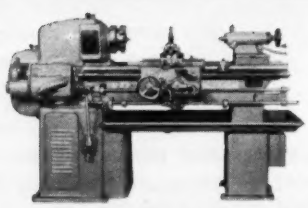
12″ — 14″ — 16″ 18-speed Geared Head Lathes



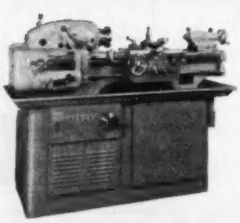
12″ — 14″ — 16″ 12-speed Geared Head Lathes



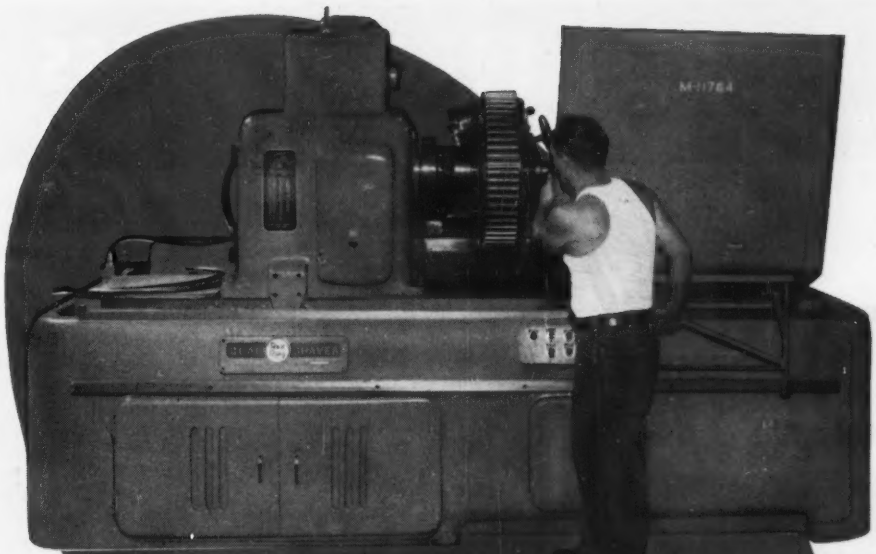
No. 2 General Purpose Lathe



No. 1 General Purpose Lathe



9″ x 24″ Tool & Gage-Makers' Lathe



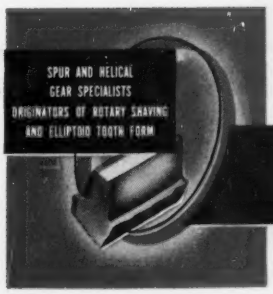
Caterpillar gears HAVE GOT TO BE GOOD!

● The unpredictable nature of tractor service, its frequent and unavoidable severity, leave no alternative to gear specifications of the most rigid character including close dimensional tolerances.

Furthermore in order to attain maximum gear service life and avoid critical "end bearing" due to slight changes in alignment under sudden overloads, the drive gear teeth are shaved to the Elliptoid (crowned) Form.

In a recently published article on Caterpillar gear production, reference was made to gear shaving as an important factor in production economy. "Shaving not only controls dimensional characteristics of our gears, correcting gear-cutting errors and producing quiet running tooth surfaces, but also eliminates final lapping operations which were essential before shaving was adopted."

If you have to meet rigid gear specifications investigate Red Ring Gear Shaving. It delivers Precision with Economy.



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NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

ELMES INCLINED FORCING PRESS
makes this tough job easy . . . and saves 50%!

Forcing the Gear on Hoisting Drum of World's Largest Ladle Crane at The Alliance Machine Company

The Alliance Machine Company, Alliance, Ohio, builder of the world's largest cranes, gives credit to the Elmes Inclined Forcing Press shown below for making possible a *50% saving* on gear installation costs.

By their performance, Elmes Inclined Forcing Presses have earned an outstanding reputation as sturdy tools of production. Built in capacities from 100 to 1000 tons, these rugged, dependable presses are ideal for forcing heavy wheels, gears and pulleys on and off shafts; for inserting and removing bushings; for many other uses in manufacturing and maintenance.

Is your plant doing jobs like these the hard way—the costly way? Why not look into the advantages of an Elmes Forcing Press? They make the tough jobs easy. Your Elmes Distributor can give you details. Write for Elmes Bulletin No. 1055-A. It illustrates and gives major specifications on the complete line of Elmes Hydraulic Forcing Presses . . . Horizontal, Vertical, and Inclined.

ELMES 500-TON INCLINED FORCING PRESS forcing a gear (9'1" diam., 10" face) on the hoisting drum of a 400-Ton Alliance Ladle Crane — world's largest. Gear weighs 8,000 lbs. Drum o.d. is 89", length 13'3", weight 33,000 lbs. Pressure of 120 tons was required to force the gear into place.

American Steel Foundries

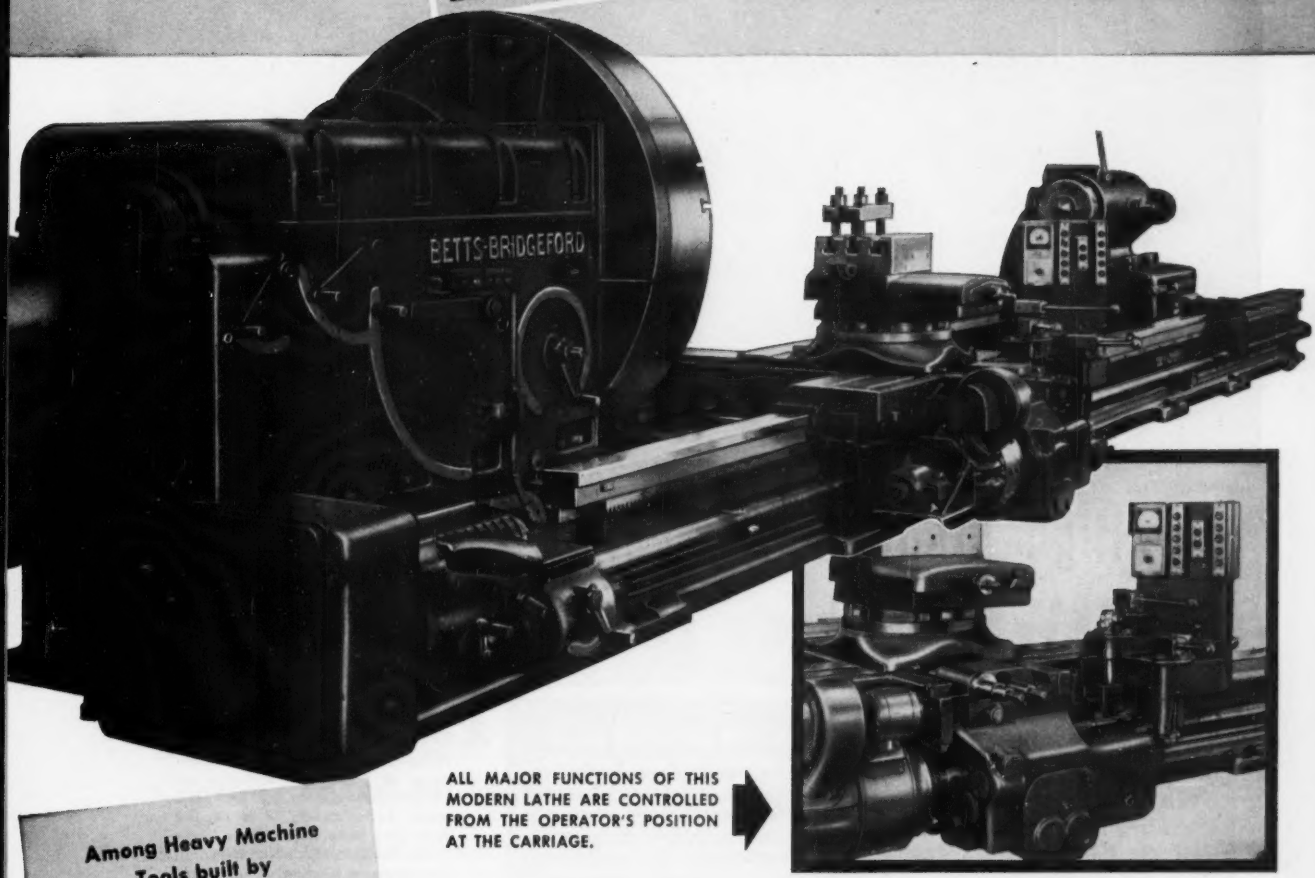
ELMES ENGINEERING DIVISION

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

BETTS-BRIDGEFORD

ELECTRONIC FEED

60" HEAVY DUTY LATHE



ALL MAJOR FUNCTIONS OF THIS MODERN LATHE ARE CONTROLLED FROM THE OPERATOR'S POSITION AT THE CARRIAGE.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

- Wide speed range permits use of either high speed steel or carbide tools.
- Feed and traverse functions entirely independent of thread cutting mechanism.
- Feed rate and cutting speed, within the range of their respective motors, are adjustable independently without interrupting the cut.
- Lead screw for thread cutting only.
- All anti-friction bearing headstock.
- Hardened steel bedways.
- Main drive motor speeds and feed and traverse functions are conveniently controlled from the operator's position at the carriage.

- Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

High Production Shearing is done at The S. K. Wellman Co., Cleveland, with this No. 110 Steelweld Shear.

For High Production Shearing STEELWELDS are "TOPS"

"What makes Steelweld Shears tops?", you ask. "Why are they so outstanding for high production shearing?" Here are some reasons:

1 EASY, FAST OPERATION Electric foot control, standard on Steelwelds, enables shearing speeds not attainable with ordinary mechanical foot treadles. Easily operated by a mere touch of the toe, it can be moved on floor to wherever most convenient.

2 SMOOTH, CLEAN CUTS Unusually smooth, clean cuts are obtained because of Steelweld's exclusive pivoted-blade cutting action. The upper knife travels in a circular path and pulls away from lower knife immediately after shearing. This prevents binding of cut pieces between back gauge and knife. Knife wear is reduced.

3 QUICK, SIMPLE KNIFE ADJUSTMENT Best possible cut for any thickness plate can be made, because of Steelweld's exclusive Micro-Set knife clearance adjustment which can be made in a few seconds.

4 CONVENIENT, ACCURATE BACK GAUGE Before the gauge at rear of an ordinary shear can be reached, a Steelweld back gauge is usually set and the machine in operation, because the adjustment is on the outside of frame near front where conveniently reached. Ball bearing equipped, it is easily operated and accurate.

5 MAXIMUM PRODUCTION Steelweld Shears are built for heavy-duty high production work. The one-piece welded steel frame and all operating details are liberally designed to provide extra stamina. Servicing is simple. All parts are easily accessible. As a result, downtime is minimum and production maximum.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5431 East 282 St. *Wickliffe, Ohio.*

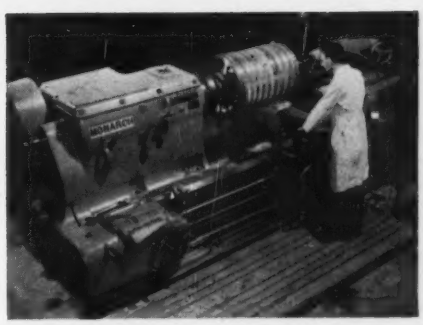
STEELWELD PIVOTED BLADE SHEARS

Monarch Lathes with Air-Gage Tracer Controls Speed Jet Engine Production

High output, and extremely accurate output, are two advantages that these dissimilar Monarch turning machines both possess in common. Each is controlled by the Monarch Air-Gage Tracer—and no other duplicating method yet devised surpasses it in speed of accurate output.

The Monarch 60" Right Angle Lathe, used principally for jet engine production today, is ideal for any thin-walled work piece with large diameter. The 32" Model NN Heavy Duty Lathe is shown contouring a rotor assembly—one of the most exacting operations in jet aircraft production. Yet it has all the size, power and rigidity, when needed, to hog heavy cuts from big work.

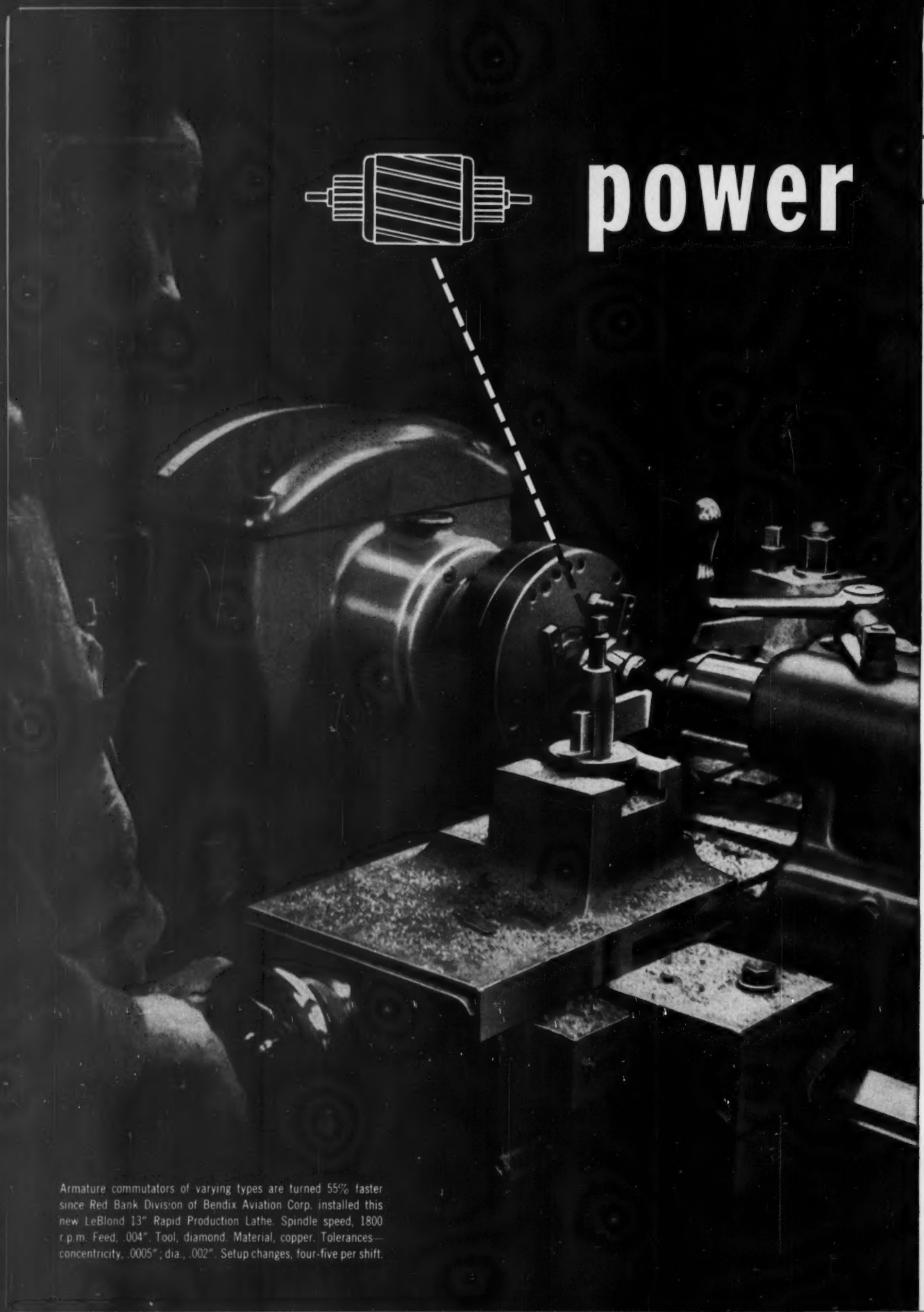
Whatever your turning, facing or boring job may be, you'll find in the complete Monarch line the lathe to produce it better, faster, more economically. *Three* different duplicating devices are applicable. And the whole story—with pictures, specifications and job reports—is instantly available to you in our complete brochures. Write for yours today! . . . *The Monarch Machine Tool Co., Sidney, Ohio.*



Monarch 32" Model NN Heavy Duty Lathe with swivelling Air-Gage Tracer. Machine may be used for a wide variety of turning, boring or facing operations—under tracer or conventional manual control.

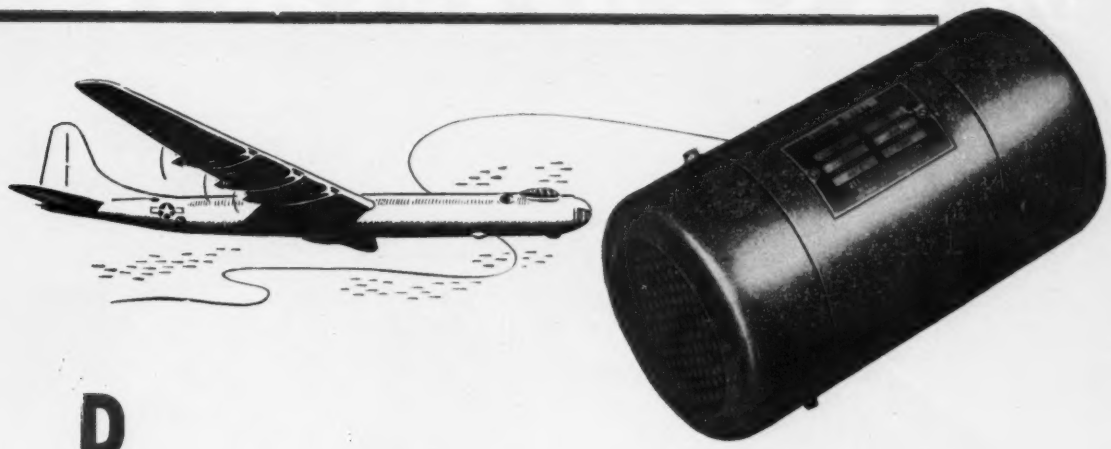
Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH



Armature commutators of varying types are turned 55% faster since Red Bank Division of Bendix Aviation Corp. installed this new LeBlond 13" Rapid Production Lathe. Spindle speed, 1800 r.p.m. Feed, .004". Tool, diamond. Material, copper. Tolerances—concentricity, .0005"; dia., .002". Setup changes, four-five per shift.

for an airplane's eyes and ears



Power for vital radar and communications equipment in airplanes is supplied by dynamotors like this. They're made in dozens of types and sizes to provide precise, unfailing power for the variety of electronic accessories used in modern aircraft.

Heart of the dynamotor is the armature. Its commutators require turning to high degrees of finish and accuracy for dependability under all flight conditions. For this job Red Bank Division of Bendix Aviation Corp. needed a precision production lathe, versatile enough to handle the entire range of sizes without costly setups. They installed a new LeBlond 13" Rapid Production Lathe . . . recommended by the LeBlond New York Office. Result? *Production increased 55%.*

This LeBlond Lathe makes possible high-production turning of a *variety* of work within the range *you* choose. It offers your choice of two geared and one motor headstock with various speed combinations from 68 to 3600 r.p.m., feeds from .001" to .064". A score of attachments is available.

Whether you turn tiny armatures or ten-ton shafts, there's a LeBlond Lathe to turn them faster, better. Your nearby LeBlond Distributor will tell you about the 13" Rapid Production and other late models. Call him or write . . .

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

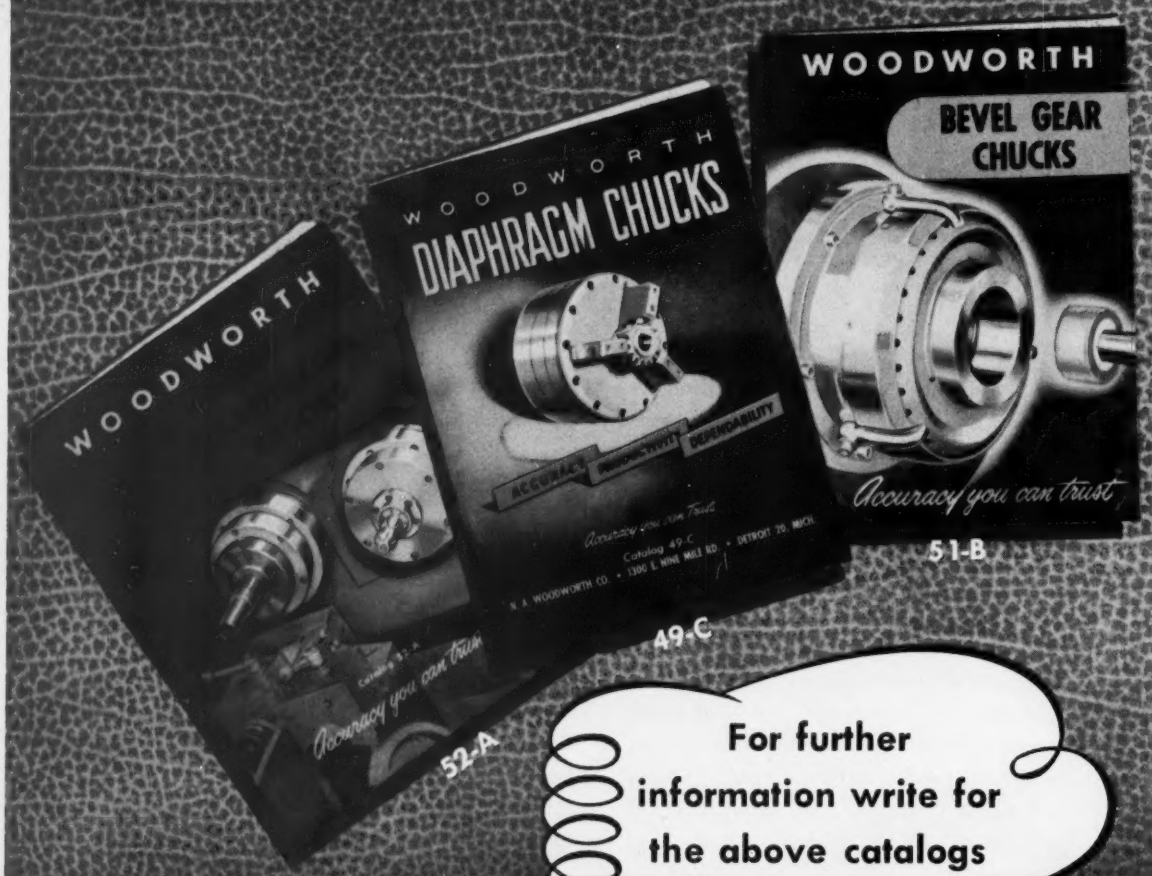
Ask for Bulletin RP-201 D for more information on the 13" Rapid Production Lathe.

turned faster by

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 63 YEARS*

Precision Chucking by WOODWORTH



For further information write for the above catalogs

Accuracy you can trust

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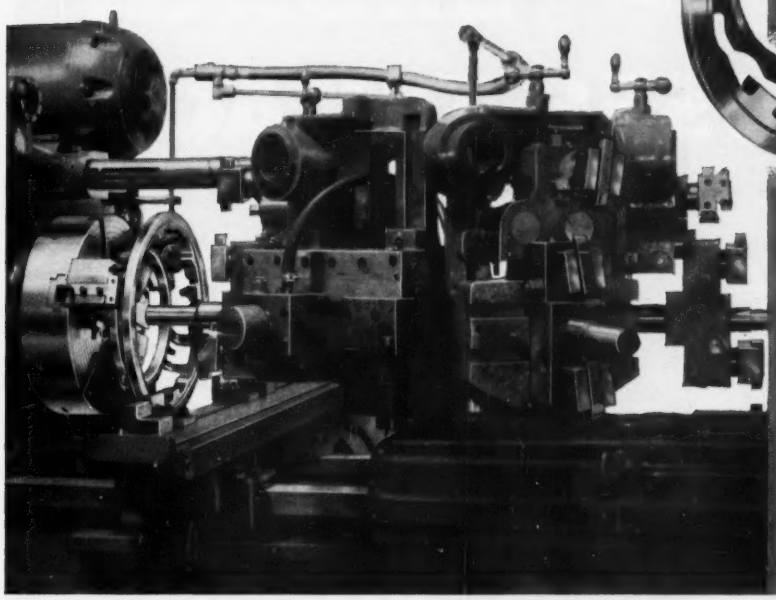

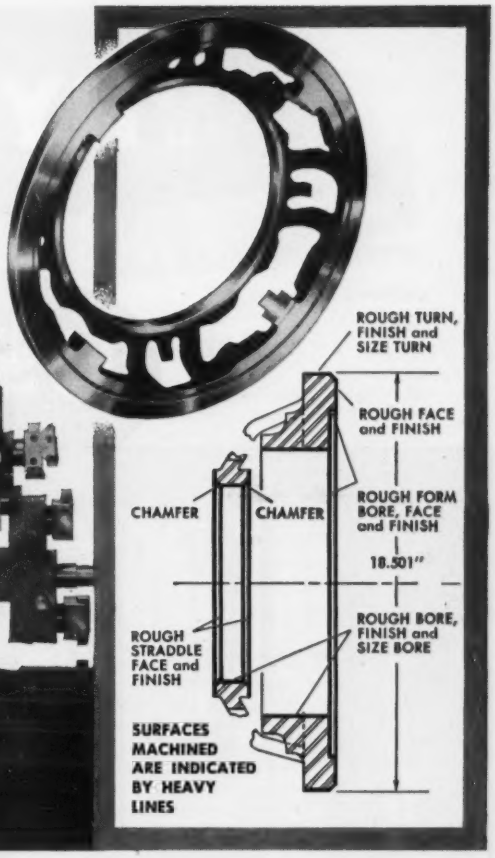
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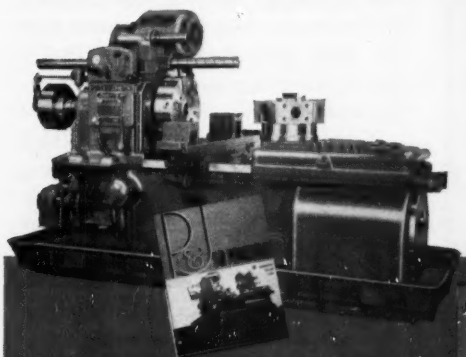

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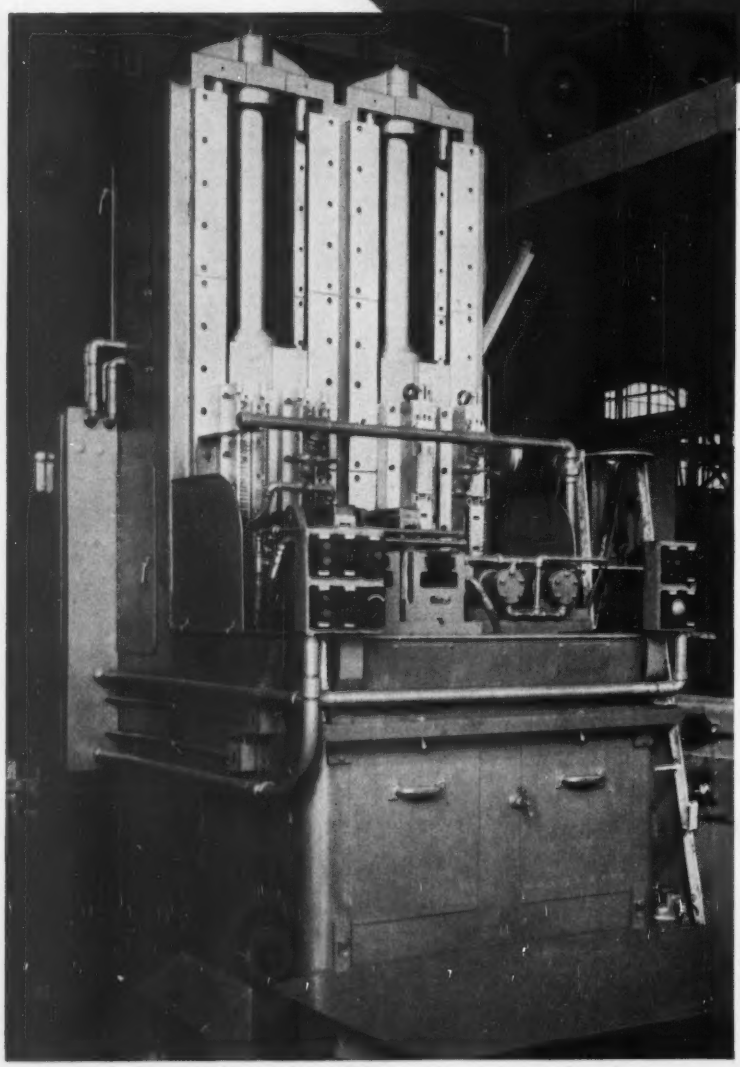

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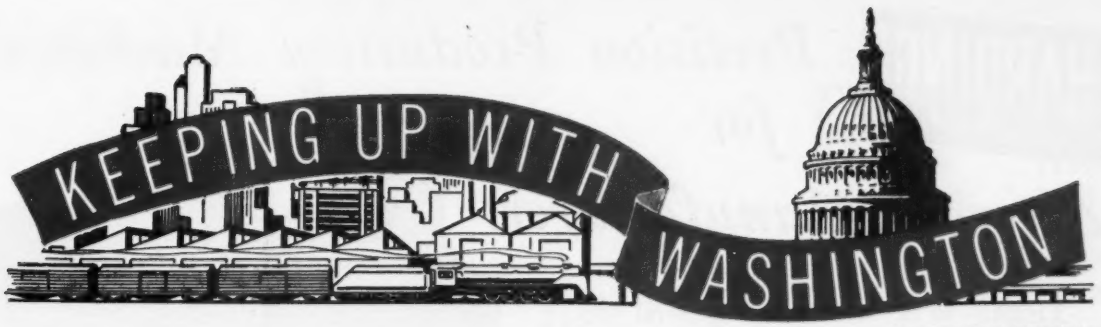

By LORING F. OVERMAN

Changing Patterns on the National Scene

WASHINGTON, customarily kaleidoscopic, is intensely so these days. At 1600 Pennsylvania Avenue, the President and his staff advise Congress and the Nation that now is not the time to cut taxes. On Capitol Hill, vote-conscious Congressmen and Senators try to deliver the tax cuts promised during the electioneering last fall. In the same breath, they question the wisdom of economy measures.

Each effort to trim expenses brings a wail of protest. Proposals to cut some $5,000,000,000 from the Air Force program were hailed as foolhardy. Another suggestion that $2,000,000,000 might be trimmed from the Atomic Energy program proved equally distasteful—to those affected, of course.

Savings—Paper and Otherwise

There is evidence that considerable "water" still remains in some of the major programs, although the new Administration seems to be finding it more difficult to wring out than was anticipated. Defense Secretary Wilson recently told the Senate Appropriations Sub-committee, that despite proposed cuts, the Air Force will have four times as much money available for new aircraft and parts during the coming fiscal year as it had in fiscal 1953.

In justifying proposed cutbacks in defense spending, Mr. Wilson said the Air Force could not get advanced plane models even if Congress voted more money than the Administration is requesting. He indicated that the Air Force has a backlog of unspent money, since it has been impossible to perfect plane types fast enough to use up the money appropriated to purchase them. Mr. Wilson said fiscal spending for planes and parts will amount to about $6,000,000,000 by June 30, while anticipated 1954 spending will be somewhere between $6,300,000,000 and $6,700,000,000. Unspent funds in addition to new appropriations will provide more than $23,000,000,000 for the coming fiscal year.

Production Equipment "In"

Proposed budget cuts have not as yet eliminated the $500,000,000 item mentioned by the Vance Committee on Production Equipment as a start toward creation of production capacity for military items. The half billion dollars has been earmarked for government purchase of machine tools of types required for military production.

Military planning also includes special rules for the assignment of ratings by military contractors to acquire production equipment. Applications for permission to use a rating and related identification symbol are to be made on Defense Department Form 691 if title to the equipment is not to be vested in the Defense Deparment. The form covers scientific instruments and equipment needed for research and development; tools, jigs, dies, and fixtures; major repair parts or office equipment needed to fulfill a military order; and equipment for service contractors. After showing that the equipment is needed to fulfill a military contract, the rating of DO-B-8 will be assigned, along with the allotment symbol B-8. Such contracts were formerly identified as Z-8 and Z-9 orders, and were given special consideration under the Controlled Materials Plan.

THE new procedure and application from will not apply to orders for construction machinery and equipment, which are governed by the terms of NPA Order M-43A. Orders for production equipment and machinery which will become the property of the Defense Department will be handled differently. In general, such orders will be identified by the symbol B-9. Equipment purchased for and mounted as a part of floating equipment will carry the symbol A-3. If the order is for construction machinery to be used as production equipment, the symbol prescribed is C-9.

For installations of government-owned equipment in a privately operated plant, the allotment symbol D-9 will be used. The symbols and regulations are a part of the new Defense Materials System, which replaces the Controlled Materials Plan. This system is intended to assure deliveries of controlled materials only for the military and the Atomic Energy Commission, starting in the third quarter of 1953.

Orders issued under the Defense Materials System include Order M-1A, applying to the steel industry, and superseding CMP Order M-1 and M-6A (issued May 14); Order M-5A, covering aluminum industry rules; and Order M-11A, covering copper (the last two issued May 6). In addition to the new general orders, others apply to nickel-bearing stainless steel (Direction 1 to DMS Reg. 1, and Schedule A to Order M-80). Rules for distributors follow the pattern of Order M-6A.

Depreciation Policy Welcomed

One recent announcement from Washington has been received with enthusiasm by all concerned. It involves a new administrative policy with respect to depreciation adjustments for tax purposes. The policy, announced by T. Coleman Andrews, Commissoner of Internal Revenue, provides that changes in the taxpayer's estimate of depreciation are to be proposed "only where there is a clear and convincing basis for a change."

The Commissioner stated, "Among the factors which should be given careful consideration in order to give full force and effect to the announced policy are the following: (1) Whether depreciation rates used by the taxpayer are fair and reasonable under the circumstances; (2) whether the taxpayer has followed a consistent practice in arriving at the amount of depreciated deductions; and (3) whether, in considering all factors including reasonable tolerances, any adjustments proposed are substantial."

THE Small Defense Plants Administration has issued a specifications directory for use by small businessmen desiring to bid on either civilian or military government contracts. This is said to be the first nation-wide listing of places that maintain either partial or comprehensive files of standard government specifications, or military and civilian specification indexes which may be consulted by businessmen. The directory lists 500 locations where information can be obtained.

Copies of the directory are available for reference at all field offices of the Small Defense Plants Administration and the Department of Commerce; at libraries receiving government publications; and from small-business specialists attached to the Army, Navy, and Air Force.

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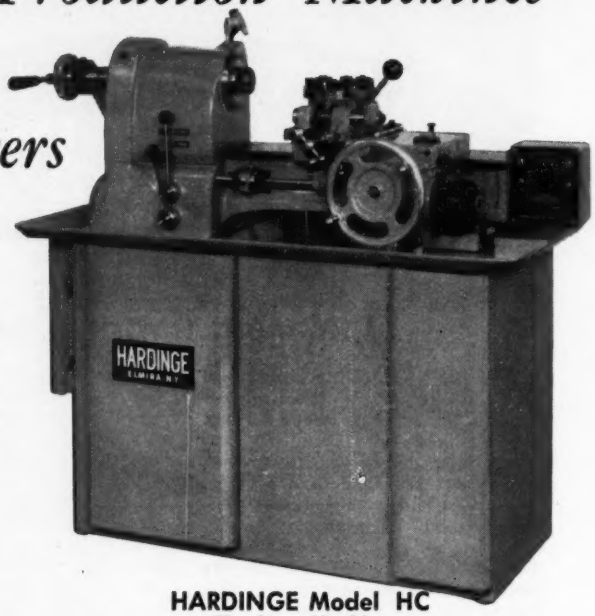
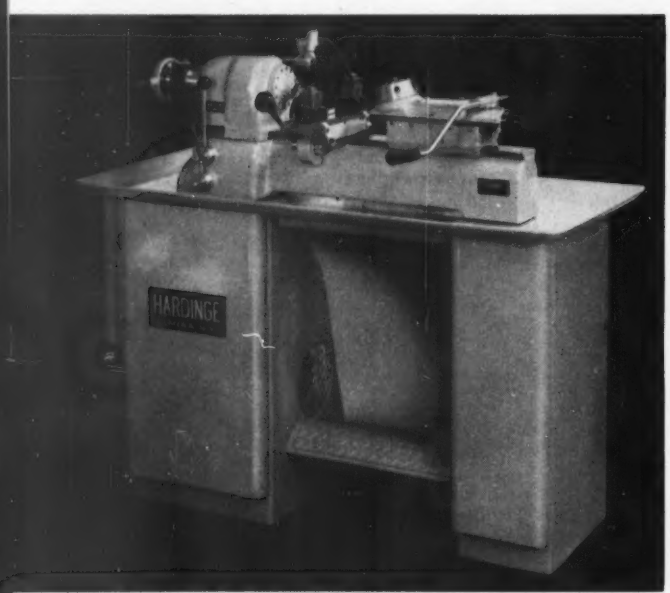
Precision Production Machines for Aircraft Manufacturers

THERE is a widespread general acceptance of these machines as being capable of meeting the extreme accuracy requirements of the aircraft industry. They combine high speed, accuracy, ease of operation, and low initial cost. This means tool room accuracy, better part finish and low cost production. These fast-action machines are cutting costs on jobs which were usually allotted to large, slow and expensive machines.



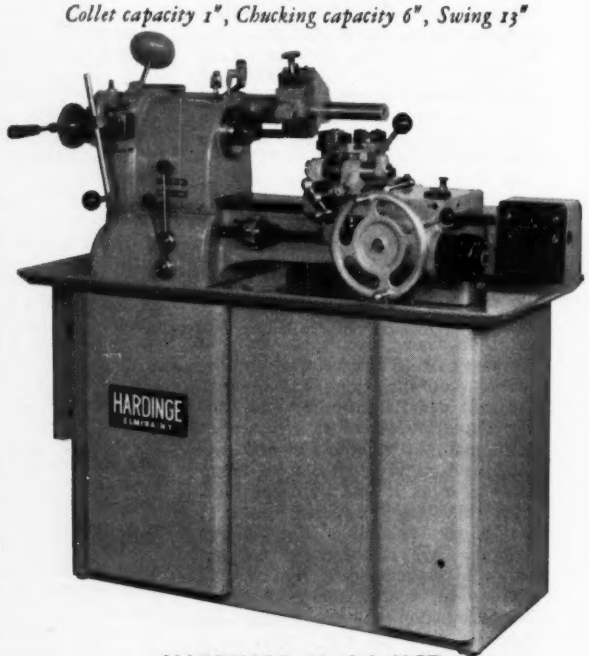
HARDINGE Model HC
Chucking Machine
Collet capacity 1", Chucking capacity 6", Swing 13"



HARDINGE Model DSM 59
Second Operation Machine
Collet capacity 1", Chuck capacity 6"

The Hardinge Second Operation Machine is a time-tried production machine, easy to set up and relatively inexperienced operators can turn out parts rapidly to close tolerances and fine finish.

The extreme accuracy and high speed of this machine enable you to chuck partially finished parts and to rapidly do close tolerance turning, forming, boring, drilling,threading and facing.



HARDINGE Model HCT
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Hardinge Precision Chucking Machines can finish diameters, shoulders, end faces and cut precision threads in *one setting—all concentric* with each other.

Everyone responsible for the machining of precision parts appreciates the value of machines which can be quickly and inexpensively tooled. These Hardinge machines can be tooled with standard tool bits for fast production of precision parts.

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MACHINERY
JULY 1953

From Crates to Jets and Guided Missiles

THE little biplane with which the Wrights ushered in the age of powered flight back in 1903 was a frail contraption of wood, doped canvas, baling wire, and a sputtering 16-horsepower engine. The plane reached an altitude of 10 feet in its initial flight, remained airborne for twelve seconds, and flew at an estimated speed of 30 miles per hour for a distance of 120 feet—just about half the wingspan of a modern bomber. The scientific world was electrified over this performance, even though few men visualized a new era of transportation and aerial combat on the threshold.

Fifty years after, man has flown close to 80,000 feet above the earth's surface at the incredible speed of 1238 miles per hour. Commercial air lines encircle the globe and fly billions of passenger miles annually. Military aircraft for combat service are now powered by engines based on principles hardly conceived a decade ago. Guided missiles—airplanes without human pilots—have hurtled through space at a speed of 3500 miles per hour. Two manufacturing concerns are attempting to develop aircraft powered by nuclear energy. The possibilities tax the imagination!

The achievements of the aeronautical scientists and designing engineers have been indeed great during the first fifty years of aviation, but almost as spectacular have been the feats of the production men that made a big industry possible. For today, aircraft building is one of our country's biggest industries. Over 750,000 men and women are directly employed in the manufacture of airframes, engines, and propellers. Another 250,000 are engaged in producing the countless instruments and accessories that are made by subcontractors of the aircraft industry.

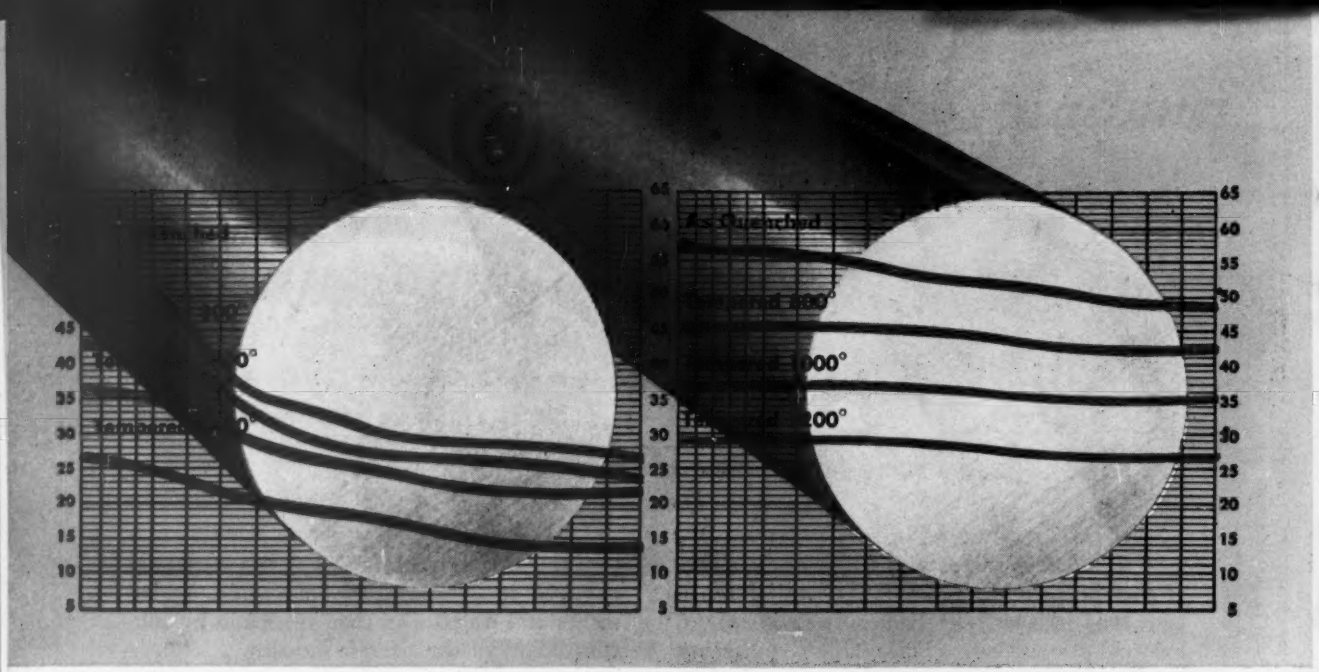
Standard types of machine tools were used in building engines for the early planes, and simple woodworking and fabric-sewing machines for the airframes. Even when planes were first constructed of metal, the manufacturing methods were quite primitive in comparison with the processes in vogue today. But the manufacturing plants of the industry were universally staffed with competent production men during World War II and, under the urgencies of the conflict, these men were able to institute unique practices that enabled the fast turning out of the thousands of planes required to win the war. The adage "Necessity is the mother of invention" was never truer than during this period.

Today, standard machine tools are still used extensively in aircraft building, but they are of modern types far different from those of the early days. In addition, there are many special machines which were designed to meet the peculiar needs of the industry. That new processes are still being developed almost daily will be strikingly apparent from the special editorial section in this Thirteenth Aircraft Production Number.

MACHINERY congratulates the aircraft industry upon the occasion of its Fiftieth Anniversary, and hails the achievements of both its design and production engineers.

Charles O. Herb

EDITOR



Same Alloy...but *What a Difference!*

Graphic Reason for Using Ryerson Certified Alloy Steel

Here are two bars of alloy steel recently purchased by a metalworking company. Both are the same type of alloy—AISI TS 4140 annealed. And both are high quality steels with chemistry meeting all the requirements of the specification.

But look at the difference revealed by hardenability tests!

The tempered-at-800° curves are typical. For the bar at left this curve starts at 44 Rockwell C and ends at 24. For the bar at right the same curve starts at 45—ends at 42. And the differences in hardenability naturally reflect equally marked differences in the mechanical properties that can be obtained from each bar.

Yet remember both bars are the same alloy and therefore are often expected to react in the same way. Their differences are only the normal variations that occur between different heats within the same specification.

That's why it is so important for you to specify and buy Ryerson Certified Alloys. *Every heat* of as-rolled and annealed alloy steel from Ryerson has been tested for hardenability in our own laboratory. When you receive a shipment of Ryerson alloys you also receive a Ryerson Alloy Certificate which shows exactly how *your particular heat of steel* responded to those tests. And the Certificate interprets the test results for you in terms of mechanical properties.

Thus you know the actual—not just the theoretical—hardenability of your alloy steel from Ryerson. And you know exactly how to heat treat that steel to obtain the desired properties. So why guess at hardenability? Use Certified Ryerson Alloys and be sure.

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Fifty Years of Flight

In 1903, the aircraft industry comprised two determined brothers and a Dayton, Ohio, bicycle shop. Within fifty years—a period considerably less than the average span of human life—aircraft manufacture has become one of America's great industries. Over one million employes are now engaged in turning out planes for commerce and defense. That manufacturing methods keep apace with expansion of the aircraft industry will be evident from the technical articles presented in this Thirteenth Aircraft Production Number.

Photo, Courtesy of Boeing Airplane Co.

Vol. 59, No. 11 MACHINERY July, 1953

13th AIRCRAFT PRODUCTION NUMBER

Turbo-Jet Engines Require Modern Machine Tools

By E. W. BARTLE
Special Assignments Engineer
Gas Turbine Division
A. V. Roe Canada, Ltd.
Malton, Ontario

Canadian Orenda jet engines are in quantity production with specially tooled general-purpose machines that can be adapted to any foreseeable future manufacturing requirements

AN important event in the history of the Canadian aircraft industry was the establishment late last year of Avro Canada's gas turbine production facility. A new plant, containing 708,000 square feet of floor space and the most modern machinery and tooling, is currently being employed to produce in quantity the powerful Orenda axial-flow, turbo-jet aircraft engine. This engine was developed at Malton, and is a completely Canadian product.

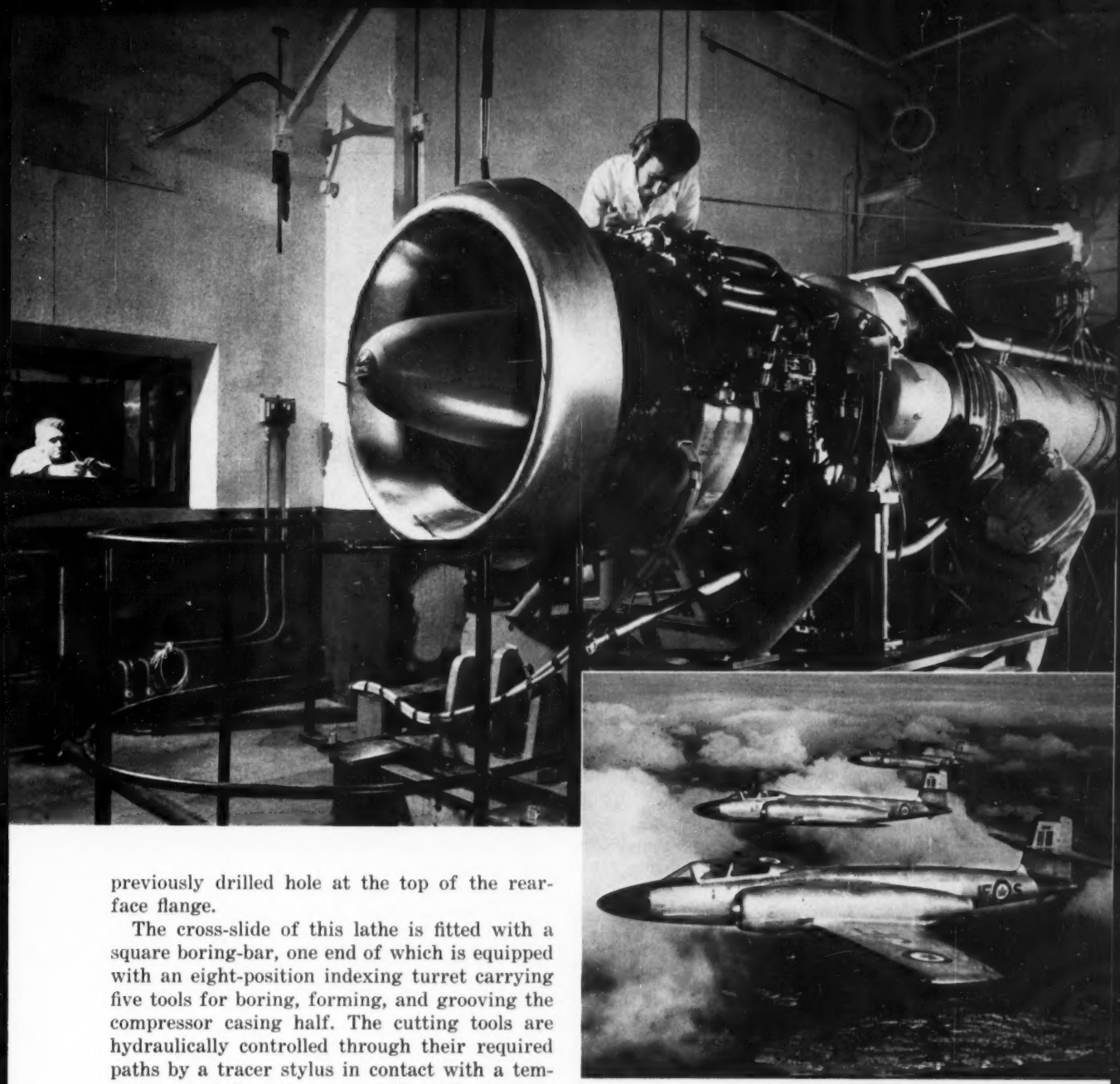
The engine was designed primarily to power the twin-jet CF-100, all-weather fighter plane being built by Avro Canada, but is also being installed in Canadian-built F-86 Sabres. The latest design of this jet engine, rated at above 6500 pounds of thrust, has a ten-stage axial-flow compressor—as seen at *A*, Fig. 1; six combustion chambers *B*; a single-stage turbine *C*; and an exhaust assembly *D*. Nominal diameter of the engine is 42 inches, over-all length is approximately 10 feet, and its dry weight is about 2500 pounds.

An interesting fact is that the engine contains about 2500 parts (exclusive of bolts, nuts, and washers), including more than 1700 vanes *E*, blades *F*, and buckets *G*. At high speeds, the engine "grows" 3/4 inch in length, while each turbine disc and bucket "grows" 1/4 inch. The tips of the turbine buckets travel at 750 miles per hour —causing a pull of about 250 tons on the turbine disc. Dimensional tolerances on certain parts of the engine must be maintained as close as 0.0002 inch.

Machine tools for this jet-engine plant were selected on the basis of utilizing them to the greatest possible extent in the manufacture of subsequent improved model engines. This careful planning has already resulted in manufacturing economies, and will insure rapid production of new design engines. Examples of the many general-purpose machine tools that have been specially tooled for jet-engine production will be described in this article.

Compressor stator casings for the Orenda turbo-jet engine are made from magnesium alloy, cast in longitudinal halves to form an upper and lower casing, *H* and *J*, respectively, Fig. 1. Each half weighs approximately 224 pounds, as cast, and 143 pounds after machining. All internal diameters of the castings are rough contour-bored on a duplicating lathe, Fig. 2, built by the American Tool Works Co.

Rough contour-boring is performed on one half-casing at a time. The casting is held in a cage type, counterbalanced fixture that has a bolting ring at the headstock end to fit the face-plate of the lathe, and another ring at the opposite end to fit the steadyrest. The work-piece is positioned centrally on its joint face, and against its rear face, locating by means of a pin in a



Avro Canada Twin-Jet CF-100
All-Weather Fighters

previously drilled hole at the top of the rear-face flange.

The cross-slide of this lathe is fitted with a square boring-bar, one end of which is equipped with an eight-position indexing turret carrying five tools for boring, forming, and grooving the compressor casing half. The cutting tools are hydraulically controlled through their required paths by a tracer stylus in contact with a template mounted on the rear of the lathe. As can be seen, the cross-slide operates at an angle of 45 degrees with the axis of the compressor casing.

Grooves are plunge-cut in the casing bore with the work rotating at 103 R.P.M. and the tools fed 0.005 inch per revolution. The work speed is increased to 145 R.P.M. for contour-boring, and the tools are fed at the rate of 0.010 inch per revolution. About 0.075 inch of stock is left on all the internal surfaces for finish contour-boring.

Finish contour-boring is performed on the same type duplicating lathe, with the upper and lower compressor casings bolted together and steadyrest rings bolted to both ends of this assembly. The same type template, carriage bar gages, and cross-slide stops used in rough contour-boring are employed for this operation. The finishing turret is equipped with eight tools, as seen in Fig. 3, for boring, forming, and grooving. Dimensional tolerances held on the various

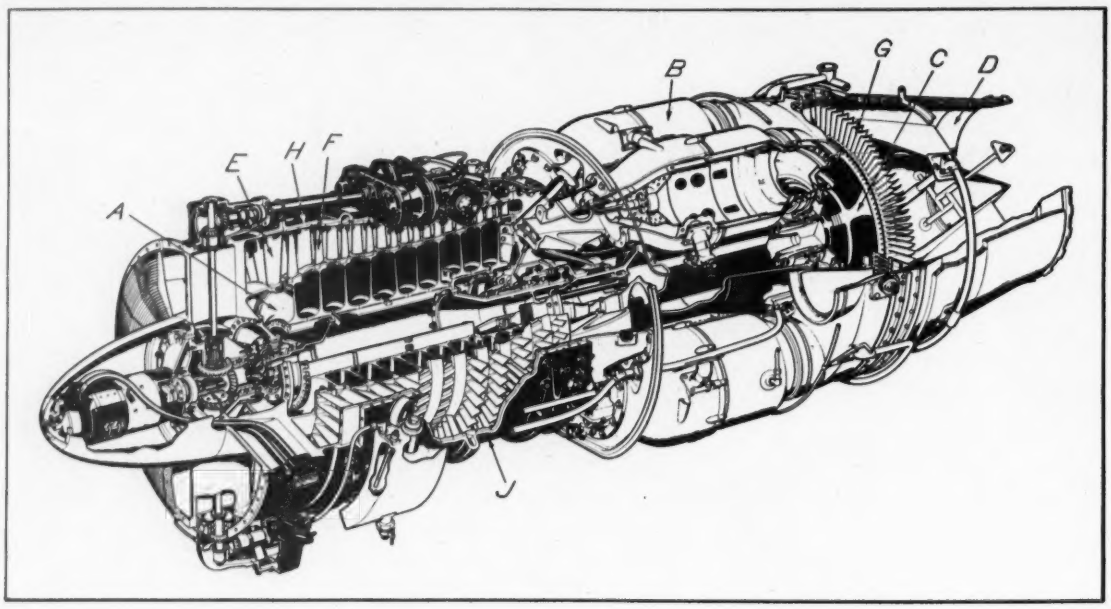


Fig. 1. Cut-away view of Orenda turbo-jet aircraft engine showing ten-stage axial-flow compressor (A), combustion chambers (B), and turbine (C)

surfaces of the compressor casing are shown in Fig. 4, and surface finish is maintained within 63 micro-inches r.m.s.

During finish contour-boring, the compressor casing is rotated at 245 R.P.M.—providing cutting speeds varying from 1725 to 2040 feet per minute—and the tools are fed at the rate of 0.010 inch per revolution. When plunge-cut forming, the work speed is reduced to 103 R.P.M., and the tools are fed at the rate of 0.005 inch per revolution.

Bosses and pads on the compressor casing assembly are milled, drilled, counterbored, and tapped on the Giddings & Lewis horizontal boring mill shown in Fig. 5. The boring mill is equipped with an automatic, electric positioning device for fast, accurate positioning of the workpiece. The same steadyrest rings employed for finish contour-boring are used to locate the assembly, and the table of the boring mill is equipped with a special universal fixture in which the work can be both rotated and indexed to present the various surfaces to the cutting tools. The cutting tools and adapters required for this operation are kept in compartments on a bench (seen at the lower right) adjacent to the operator.

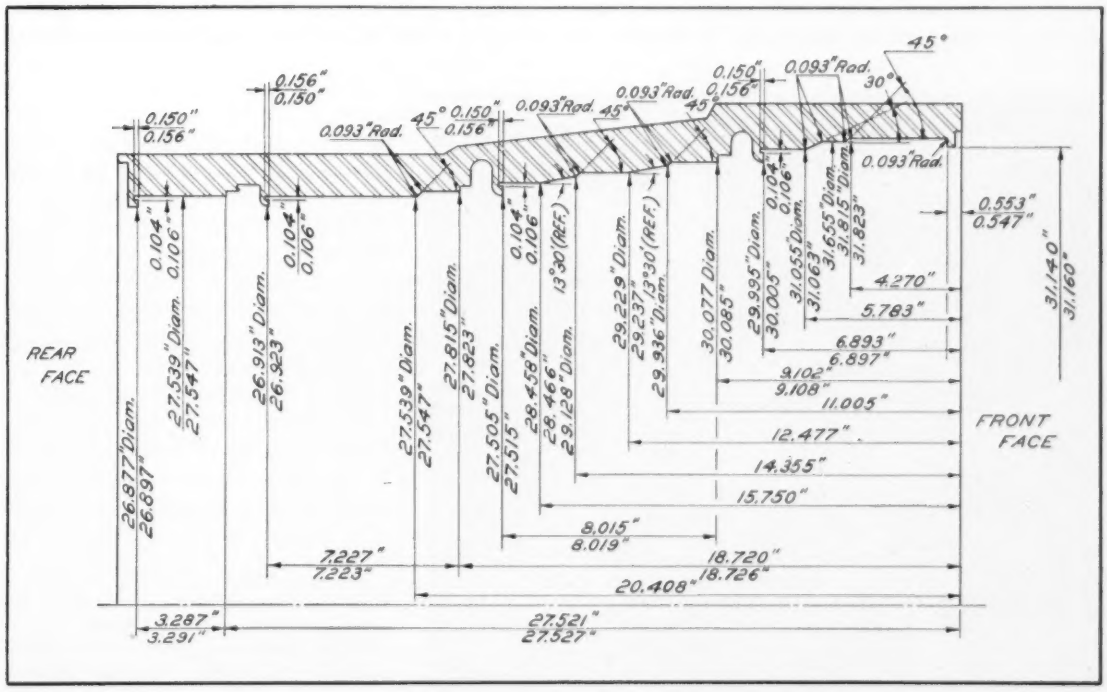
Compressor rotor discs for the turbo-jet en-

Fig. 2. Contour-boring of compressor casing on hydraulic duplicating lathe. Template for controlling tools is seen at center.

Fig. 3. End of square boring-bar on the duplicating lathe seen in Fig. 2 is equipped with turret carrying eight boring, forming, and grooving tools.

gine are forged from an aluminum alloy for the first nine stages, and from a heat-resistant chromium-molybdenum alloy steel (similar to S A E 4140 steel) for the tenth stage. Both front and rear faces of these discs are rough profile-faced on King vertical turret lathes, such as the one shown in Fig. 6. The lathes are equipped with two-dimensional hydraulic tracing systems that simultaneously control both the vertical movements of the slide and horizontal

Fig. 4. Sectional drawing of compressor casing showing dimensional tolerances maintained. Surface finish of 63 micro-inches r.m.s. is obtained.



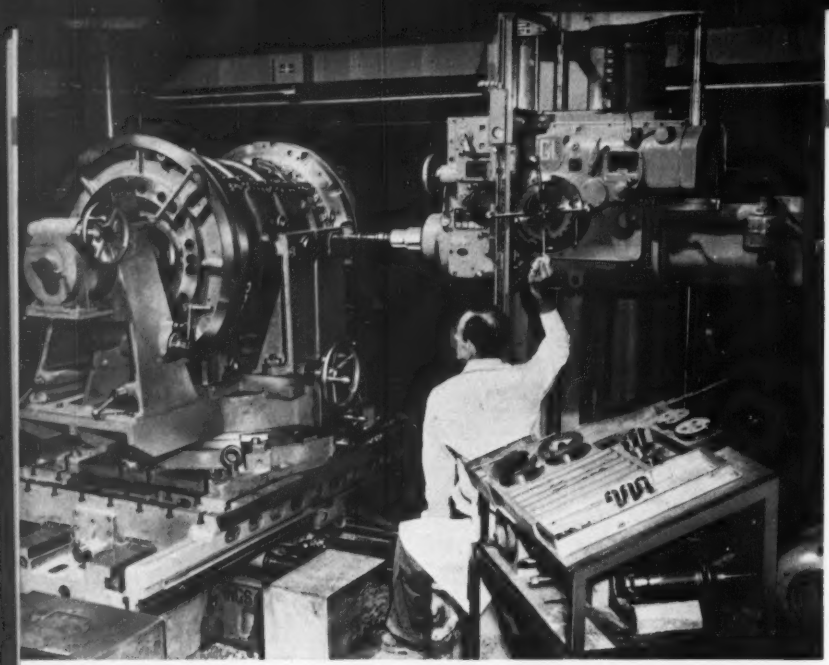


Fig. 5. A universal fixture is mounted on table of boring mill for milling, drilling, counterboring, and tapping bosses and pads on casing.

movements of the ram. In this way, the shape of a flat metal template is duplicated in the forging by controlling the cutting tool through the action of a stylus that moves over the surface of the template. From 1/4 to 5/8 inch of stock is removed from each face in two passes with the work rotating at 200 R.P.M. and the tools fed at the rate of 0.010 inch per revolution. About 1/16 inch of stock is left for finish-machining.

Finish profile-facing of the compressor rotor discs is performed on the Lodge & Shipley hydraulic tracer-controlled lathe seen in Figs. 7 and 9. The problem of reducing the distortion of the work-piece caused by clamping was solved by employing a combination manual, pneumatic, and hydraulic fixture, as shown in the cross-sectional drawing, Fig. 8, and the illustration, Fig. 7.

Disc *A*, which has previously been bored, is slipped over an expanding mandrel *B* and seated against faceplate *C*. A clamping plate *D* is brought into contact with the hub face on the disc by tightening three nuts *E*. Then, the man-

Fig. 6. Compressor rotor discs are profile-faced on vertical turret lathe equipped with two-dimensional hydraulic tracing system.

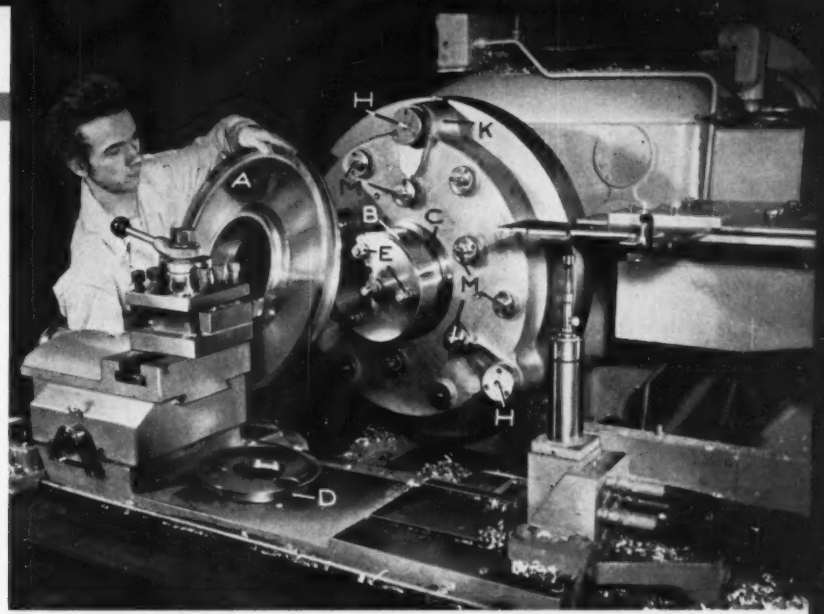


Fig. 7. Hydraulically actuated, spring-loaded plungers (M) support thin web and flange of rotor disc to minimize distortion during machining.

drel *B* is expanded onto the bore of the compressor rotor disc by actuating an air cylinder (not shown) that pulls draw-bar *F* to the left. The tapered periphery of cam-plate *G*, which is bolted to the draw-bar, slides along the tapered bore of the mandrel, thus expanding the mandrel.

One of three equally spaced, hexagon-socket type set-screws *H* is then tightened. The bottom of each set-screw contacts the piston-rod *J* of a master hydraulic cylinder *K*—three of these master cylinders being equally spaced in the body of the cylindrical fixture. These cylinders are connected by means of drilled holes, tubing, and fittings to twelve operating cylinders *L*, in which spring-loaded support plungers *M* are free to slide. As the set-screw is tightened (moving the piston-rods to the left in the master cylinders), hydraulic pressure is transmitted to the operating cylinders, and the plungers are moved to the right, thus contacting and supporting various points on the thin web and peripheral flange of the compressor rotor disc.

The three master cylinders are connected in series so that any one cylinder can operate all twelve support plungers. A pressure of about 1/2 ounce in the master cylinders is sufficient to adequately support the work-piece and minimize distortion during machining. The amount of pressure exerted is controlled by tightening the set-screws only until the indicator on a dial gage held in contact with the work-piece moves

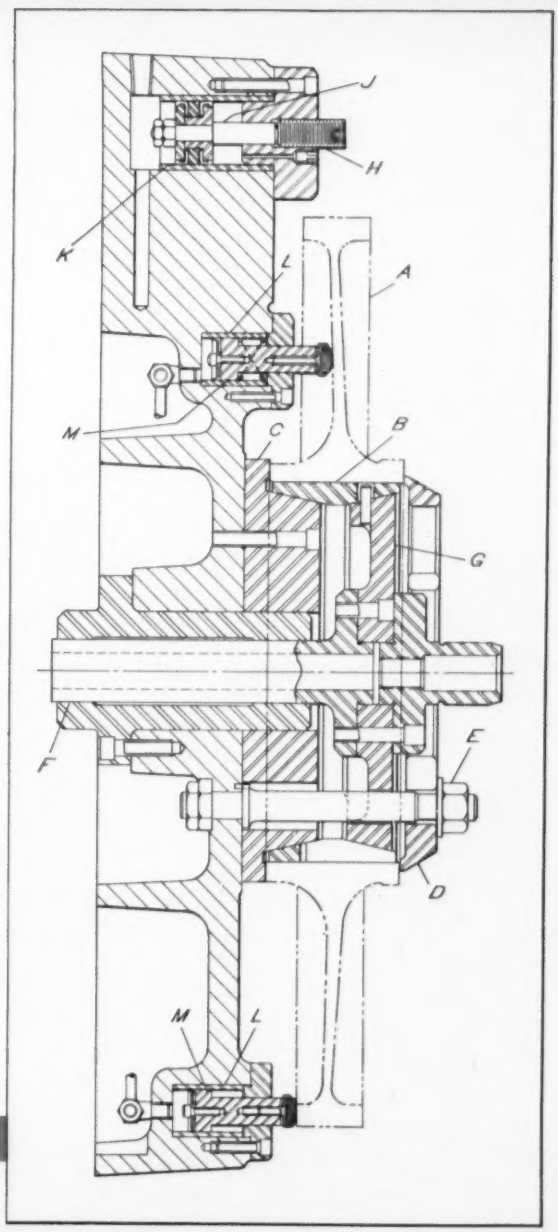


Fig. 8. Cross-sectional drawing of combination manual, pneumatic, and hydraulic work-holding fixture employed on the lathe illustrated in Fig. 9

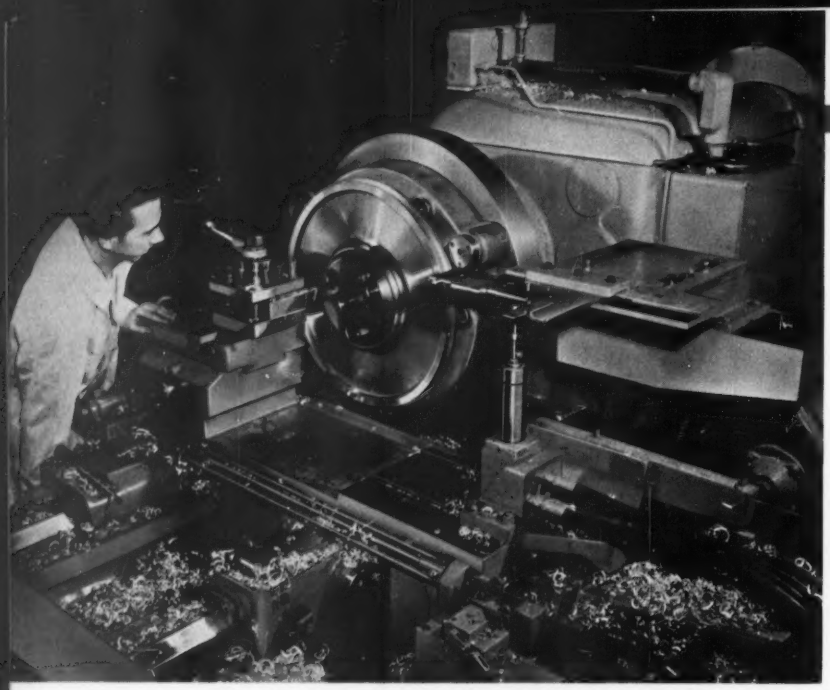


Fig. 9. Finish profile-facing of compressor rotor discs is performed on a hydraulic tracer-controlled lathe. Cutting speed is 1350 feet per minute.

0.0002 inch. The entire fixture is dynamically balanced prior to use.

In finish profile-facing the compressor rotor discs, either one or two cuts are made, depending on the stage. Each lathe is equipped with a motor-generator set and direct-current motor drive to vary the rotational speed during machining and maintain the cutting speed constant at 1350 feet per minute. The carbide-tipped cutting tool is fed at the rate of 0.010 inch per revolution. In machining the steel disc for the tenth stage of the compressor, liquid carbon dioxide is applied to the cutting edge of the tool through a fine nozzle to absorb the heat generated.

External threads are generated on the hub of aluminum compressor rotor discs (Stages 1 to 9), and internal threads in the bore of steel discs (Stage 10), on semi-automatic, high-speed threading machines such as the one shown in Fig. 10. These unique "Cri-Dan" machines are of French design, built by Sentinel in England and distributed by Lees-Bradner, Cleveland, Ohio. Threads are generated with a single-point, carbide-tipped tool that takes a multiplicity of cuts across the work-piece. The rate at which the tool is traversed across the work can be varied up to 100 strokes per minute.

An important feature of this machine is that the tool is automatically backed out of the cut by cams at the end of each stroke. With this arrangement, no relief is necessary at the end of the thread, thus increasing the strength of the discs. External threading of the aluminum disc (the thread having a pitch diameter of 10.1248 inches and a length of about 1/2 inch, with 10 threads per inch) is completed in about one-half minute, and internal threading of the steel disc in approximately two minutes. The steel compressor rotor disc for the tenth stage is rotated at 160 R.P.M., and sixteen passes of the tool are required to complete the thread.

Fir-tree serrations are broached in the discs for the first three stages of the compressor, and dovetail slots in the discs for the last seven stages, on Lapointe 15-ton, 66-inch stroke vertical broaching machines that are operated at a cutting speed of 45 surface feet per minute. The number of equally spaced serrations or slots varies with the compressor stage in which the disc is to be used.

Dovetail slots for securing vanes in the bores of compressor stator rings are machined on the Lapointe vertical broaching machine seen in Fig. 11. Half stator rings, such as those seen at the lower right, are broached one at a time, thus requiring indexing of the work-piece only through an angle of 180 degrees. The automatic, hydraulic indexing fixture is angularly mounted to permit broaching the slots at the required angle. In this set-up, the broach travels vertically inside the fixture, and automatically backs away from the bore of the compressor stator ring at the bottom of the stroke before the fixture is indexed.

Another example of the adaptation of general-purpose machine tools to the manufacture of jet engines is illustrated in Fig. 12. Here, a special

Fig. 10. External threads are generated on hub of aluminum compressor rotor disc with single-point, carbide-tipped tool taking multiple cuts.

angular indexing fixture is mounted on the table of a standard Cincinnati vertical milling machine to face the six horns of the jet-engine center casting. The vertical spindle of the machine is equipped with three single-point, carbide-tipped tools to fly-cut the horn faces.

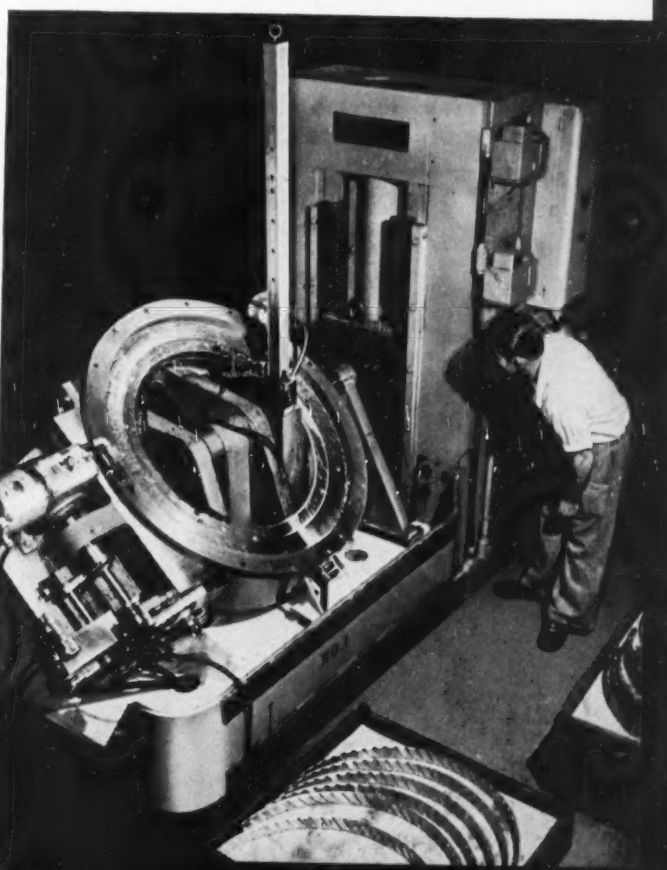
Turbine discs for the Orenda engine are forged from a Timken high-temperature-resistant alloy having a hardness of approximately 24 Rockwell C and containing about 25.5 per cent nickel, 16.25 per cent chromium, 6.25 per cent molybdenum, 0.15 per cent nitrogen, a maximum of 0.12 per cent carbon, and the balance iron. Faces and hubs of the turbine discs are profiled on a Bullard vertical turret lathe that is equipped with a General Electric two-dimensional electronic tracing system.

In this system, a magnetic tracing head having a stylus contacting a template of the required shape sends electrical signals to the control panel near the machine. These signals are modified and fed to amplidyne generators that control the speed and direction of rotation of electric motors on the machine feed-screws. Thus, the feed-screws provide the required combination of longitudinal and transverse motion of the tool to duplicate the shape of the template on the work-piece.

A Lapointe 15-ton, 90-inch stroke, vertical broaching machine, such as the one shown in Fig. 13, is employed to machine fir-tree serrations for gripping the turbine buckets in the peripheries of the 1 3/4-inch thick turbine discs. An unusual feature of this operation is the use of an aluminum disc—placed on the fixture under the work-piece as shown—to remove chips from the broach.

Chips from this high-nickel alloy have a tendency to weld to the edges of the broach teeth, and considerable brushing had been required to remove them. Now, the chips are sheared from the broach as it passes through the 1/8-inch thick aluminum disc (having a diameter slightly larger than the turbine disc). With this set-up, a minimum of hand brushing is required, and it is possible to use a heavier cutting oil having higher extreme-pressure properties. The cutting oil employed is of the chlorinated type, having

Fig. 11. Angular dovetail slots for securing vanes in bores of compressor stator rings are machined with broach traveling vertically inside fixture.



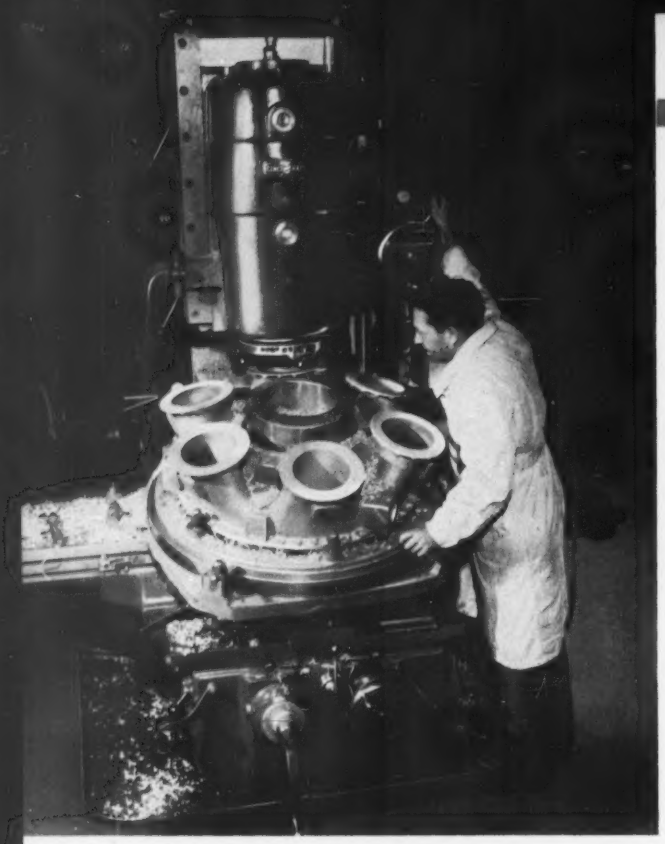


Fig. 12. Special angular indexing fixture is mounted on table of standard vertical milling machine to fly-cut faces of six horns on center casting.

as high a chlorine content as possible without becoming toxic. Although aluminum alloy is used for the chip-breaker disc in this installation, brass or other soft, non-ferrous material could be used just as well.

All 113 angular fir-tree serrations in each turbine disc are rough- and finish-broached on the same machine. A tolerance of 0.0005 inch is maintained on the profiles of the serrations, and their radial location must be within plus or minus 0.001 inch of any other serration. The chip load in broaching varies from about 0.003 inch per tooth on the rough broaches to 0.001 inch per tooth on the finish broaches.

When the tenth stage disc is assembled to its mating part, a sealing surface is required to prevent oil in the bearings from leaking. Such an oil-tight seal is obtained by turning a multiple-stepped surface on the hub of this disc, and spraying this surface after degreasing with molybdenum. This layer of metal compensates for the tolerances required in manufacturing, and, when worked by assembling the mating part to the disc, provides a satisfactory seal.

Molybdenum is sprayed on the turned surface of the tenth stage disc by means of the wire process set-up seen in Fig. 14, with equipment made by the Metallizing Engineering Co. Molybdenum wire 0.091 inch in diameter is fed by rollers through a nozzle into an oxy-acetylene flame that melts the wire. Compressed air, under a pressure of 50 pounds per square inch, carries the molten metal onto the surface being coated. Oxygen pressure is maintained at 35 pounds per square inch, and acetylene, 15 pounds per square inch. The sprayed metal thickness is limited to 0.010 inch.

Compressor rotor discs are assembled to the front, center, and rear rotor drums with a 0.020-inch interference fit between the disc bores (approximately 9 1/4 inches in diameter) and the drum peripheries. This is accomplished by heating the discs to a temperature of 325 degrees F.

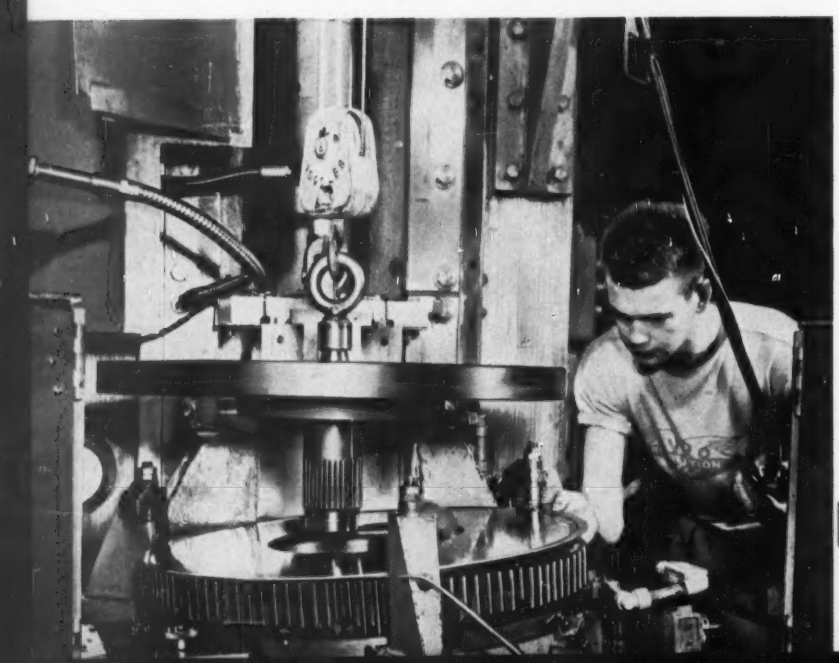


Fig. 13. Vertical broaching machine having a 90-inch stroke is employed to cut 113 angular fir-tree serrations in periphery of turbine disc.

Fig. 14. Oil-tight surface is provided on hub of disc by spraying with molybdenum that is melted in oxy-acetylene flame.

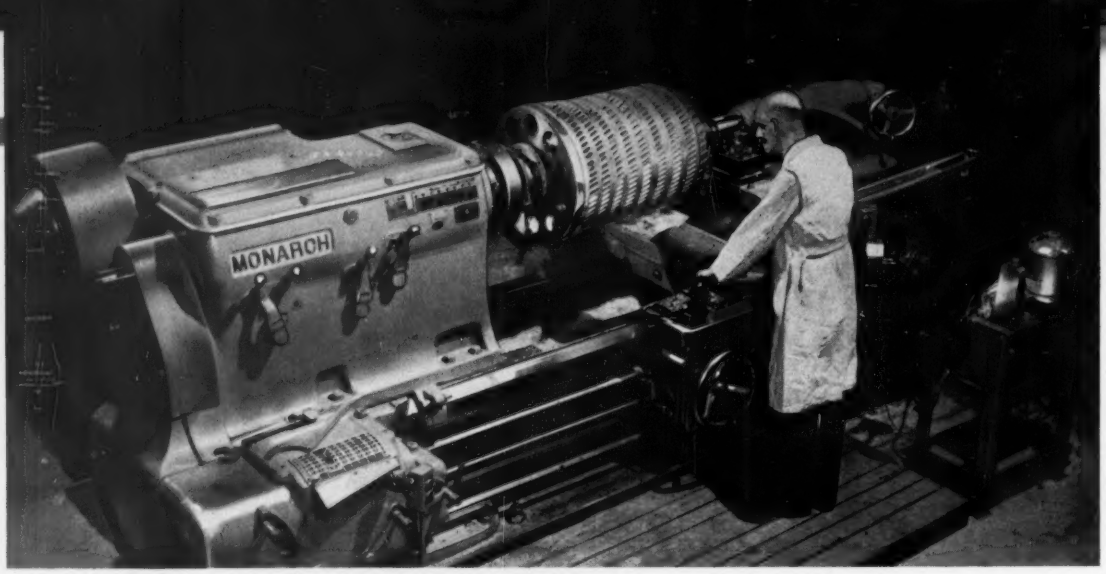
in an electric oven, which expands their bores, and cooling the drums to a temperature of 115 degrees F. below zero in a refrigerating unit, thus contracting their peripheries. The heated discs are pressed onto the cooled drums in a hydraulic press, Fig. 15. When the sub-assembly returns to normal temperature, the required interference fit is obtained.

After bolting the front, center, and rear compressor rotor sub-assemblies together, this assembly is contour-turned on the Monarch lathe shown in Fig. 16. From 0.015 to 0.020 inch of stock is removed in this operation, with the carbide-tipped single-point tool being guided through the required path by means of a flat template and pneumatic tracing attachment, seen mounted on the front of the lathe at the tailstock end.

One of the most critical assembly operations is the fitting of the compressor blades to the rotor discs, since the Orenda turbo-jet engine is unique in that a carefully controlled amount of play or wobble is specified between the dovetail slots or serrations in the discs and the roots of the blades. After assembling the blades to the compressor rotors, the outer tips of the blades are turned on the Monarch lathe, Fig. 17, the same one used for contour-turning the rotor assemblies. This is a particularly difficult operation because of the intermittent cutting required, and the fact that the blades in the first three and the tenth compressor stages are steel, while the remainder are aluminum. Wooden supporting blocks are fitted between the blades to back them up during machining, thus facilitating the interrupted cutting required.

The completed compressor rotor assembly, which weighs about 500 pounds, is dynamically balanced on the Gisholt Dynetric balancing machine seen in Fig. 18. With this machine, dynamic unbalance of the assembly is accurately measured and located angularly. Corrections are

Fig. 15. Heated compressor discs are pressed onto cooled rotor drums on this hydraulic press, providing a 0.020-inch interference fit.



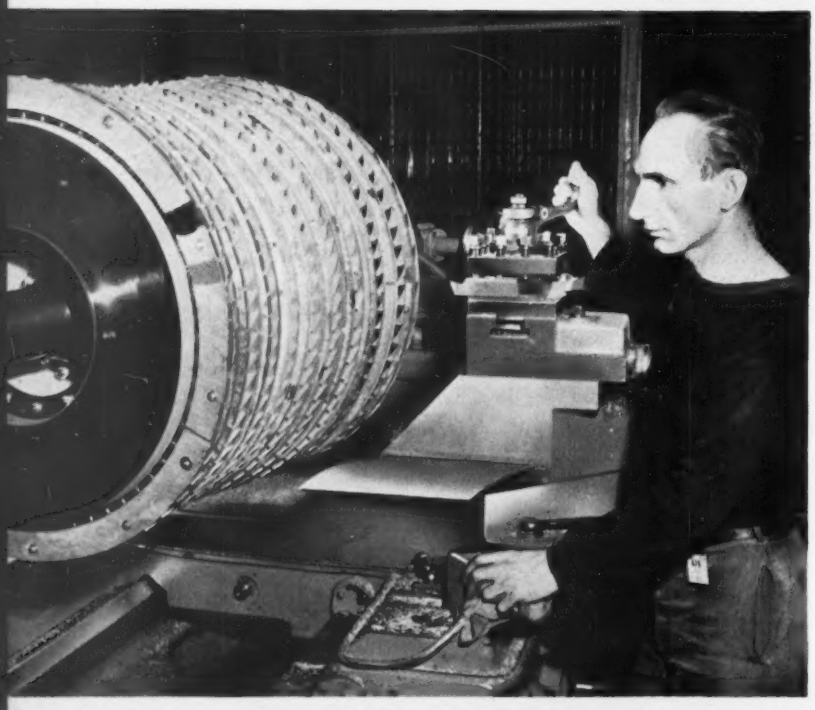


Fig. 16. (Above) Pneumatic tracing attachment is used on this lathe for contour-turning compressor rotor assemblies, removing from 0.015 to 0.020 inch of stock.

Fig. 17. Wooden supporting blocks are fitted between aluminum and steel compressor blades while turning outer tips of the blades.

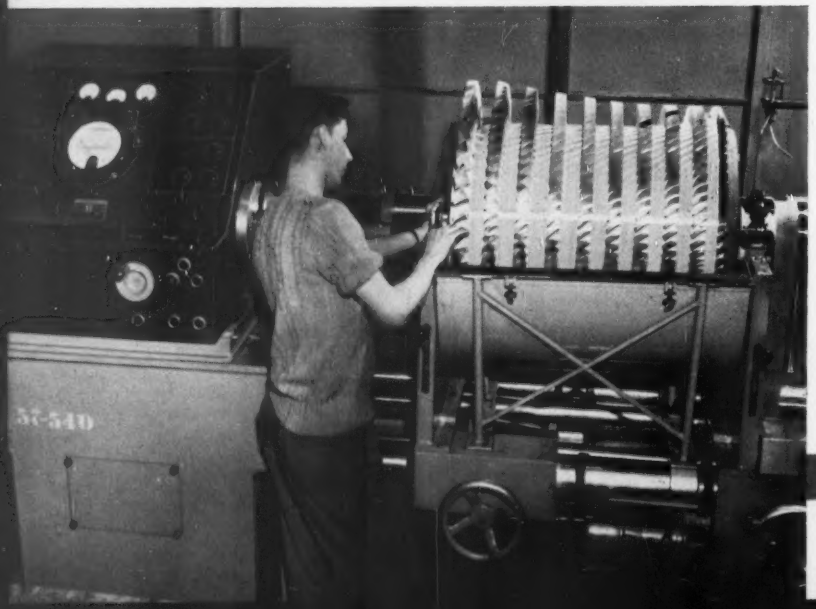


Fig. 18. Dynamic unbalance of compressor rotor assembly is maintained within 0.5 ounce-inch by adding weights to first and tenth stages if necessary.

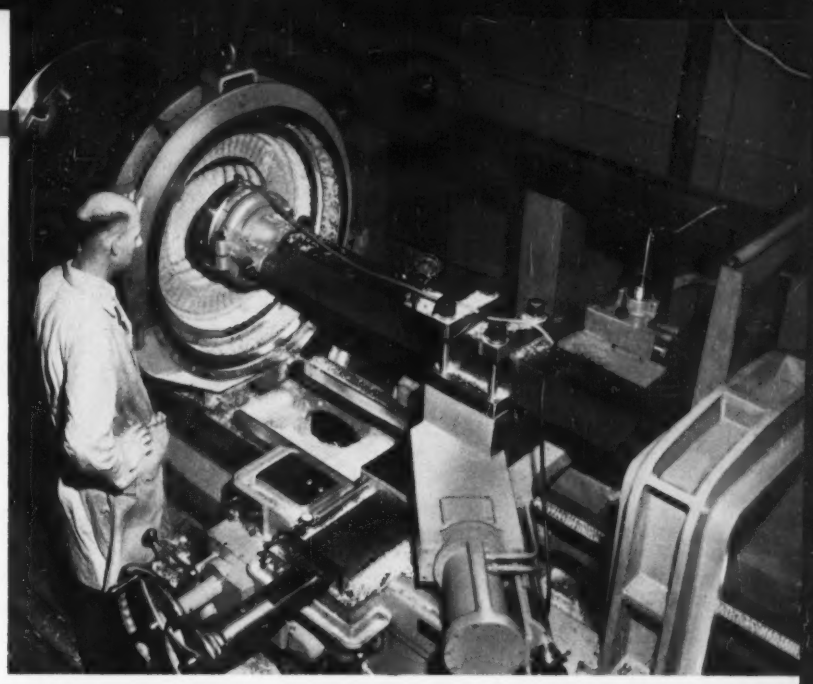


Fig. 19. Vanes in the stator casings are supported by coating with about 400 pounds of wax for contour-boring inner peripheries of the vanes.

made, if necessary, by adding steel weights (averaging 2 ounces each) to dovetailed slots in the rotor discs at the first and tenth stages of the compressor, and peening these weights in place. Dynamic unbalance is maintained within 0.5 ounce-inch.

Stationary vanes are secured in the compressor stator casings by mounting them in dovetailed rings which are retained by lips on interstage spacers bolted to the stator casing. Inner peripheries of the assembled vanes are contour-bored (called "tipping") on the American lathe shown in Fig. 19. To support the vanes during tipping, the compressor stator assembly is loaded with wax. This is accomplished by placing the assembly in a rotary fixture, and pouring molten wax into the bore of the rotating assembly until it has been built up to the required thickness. About 400 pounds of wax is required to support the vanes in each compressor stator assembly. After tipping, the wax is reclaimed by electrically heating the assembly and pumping out the molten wax.

A special portable machine, Fig. 20, is employed to finish the bore of the peripheral air seal within plus or minus 0.0005 inch, after it has been assembled to the center casting of the jet engine. The machine consists essentially of a standard Thor pneumatic grinder connected by a gear coupling to a spindle that rotates in tapered roller bearings. The bearings are secured in a split housing that can be clamped at any position along two bars projecting from the center of the machine. A micrometer dial adjustment is provided to set the housing at the required location. The spindle is equipped with a two-lip, stepped cutter that rotates at 20,000 R.P.M. The machine is held in one position, and the casting is rotated by hand about its center axis until the cut has been completed.

Fig. 20. Bore of peripherial air seal (assembled to center casting) is finished on this portable machine employing a pneumatic grinder to rotate the cutting tool.

Colossal Press Spearheads Lockheed's Skin Program

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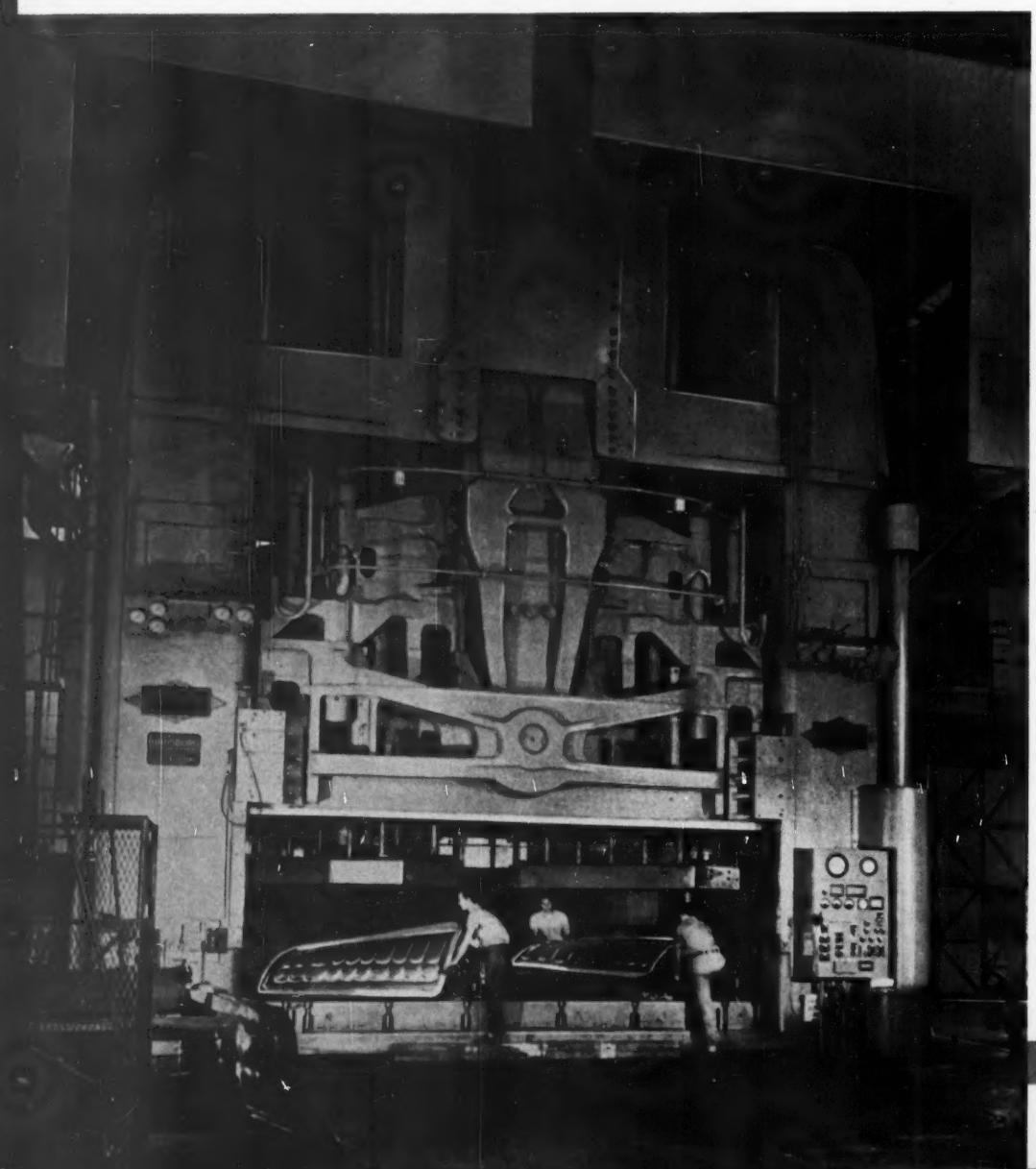


Lockheed Super Constellation

HYDRAULIC pressure equivalent to the weight of a battle cruiser can be developed by an 8000-ton Birdsboro hydraulic triple-action press in the famed "Hall of Giants" at the Lockheed Aircraft Corporation, Burbank, Calif. This machine is reputedly the largest metal drawing and blanking press of its type anywhere in the world. So immense are its proportions that one entire wing of the factory was constructed around it after the installation. It was built at a cost of $750,000.

Fabrication of many airframe parts is simplified by this press through its ability to accommodate components that heretofore could not be formed because of restricting combinations of heavy metal gages and large tonnage requirements. In fact, the press is proving indispensable to the production of many integrally stiffened skins and panels—the important new structural design in highly stressed areas of fighter and transport aircraft. In addition, wing leading edges can now be shaped or formed to their exact contours in one operation.

The press towers 33 feet above the factory floor, and the base extends almost 14 feet below the floor. Its weight of some 2,373,000 pounds rests on a 26- by 42-foot steel-reinforced concrete foundation. Three automobiles could be parked side by side in the press with room to spare. It has a maximum height opening of 7 1/2 feet and a bed size of 30 by 10 feet. Three motors —two 250- and one 75-H.P.—power the press. In single-action forming, rubber platens are employed. For one job, the press was equipped with a rubber platen 5 feet wide, 18 feet long, and 10 inches thick. This was probably the largest platen ever used in the West.

In many instances, right- and left-hand members of the same part are formed simultaneously by making both dies the same height. Set-up time has been reduced substantially, and production has been doubled over that obtained with smaller presses. Left- and right-hand stampings formed in this manner are shown in Figs. 1 and 2. The stampings in Fig. 1 are skins for nose-wheel doors, and in Fig. 2, for landing-gear doors. These parts were formed in the initial test runs of the press. Plastic dies were successfully used.

Wing-tip tanks for Super Constellations are typical of the many parts being turned out by the new press. These tanks are formed in halves, each being 44 inches wide and 181 inches long, and having a depth of draw of 22 inches. A plastic double-action die, weighing 13 1/2 tons, is used. It is believed to be the largest plastic die in the airframe industry.

Extruded or rolled light-gage integrally stiffened skins have been found practical for many surfaces which must be formed to compound contours, such as wing tips, ailerons, and elevators. The most successful technique used to produce such shapes has been by "bulging" in the Birdsboro press, at pressures of 2000 pounds per square inch. A light-gage integrally stiffened panel having a double contour that was produced by bulging is shown in Fig. 3. Tooling in this instance was relatively simple: surrounding the part is a locking ring, against which is lowered a mating hydraulic clamping cover. The contours of the part are established by means of a plastic block fitting in the locking ring.

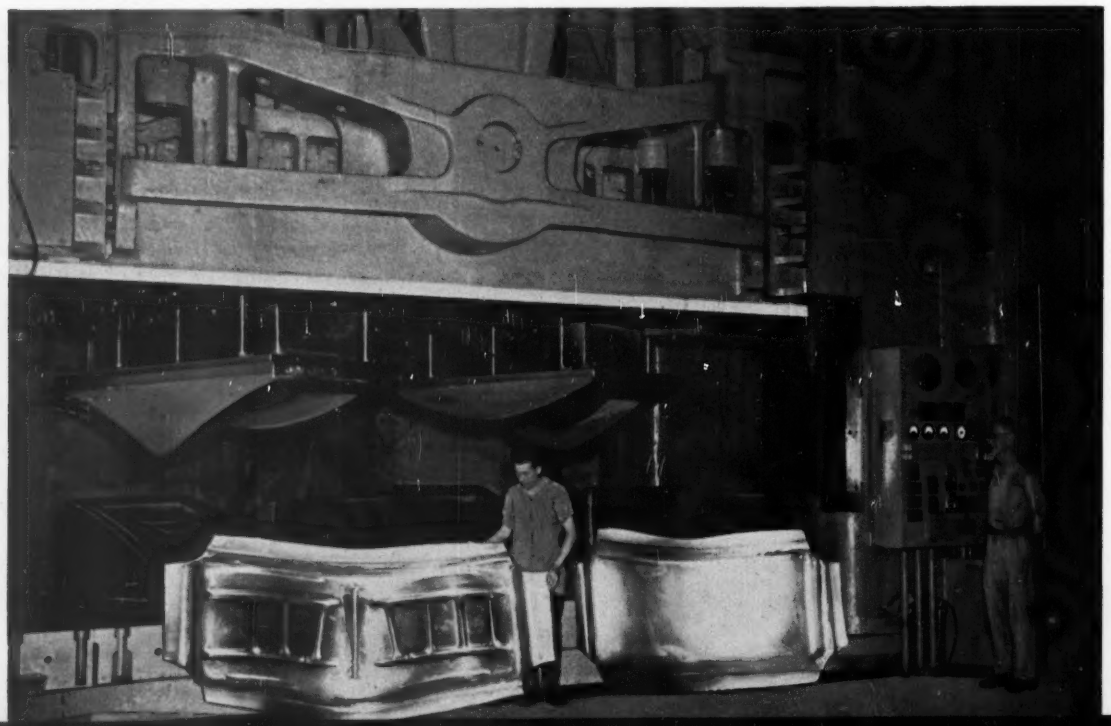
The new press performs an important function in the stretch-leveling of heat-treated thick aluminum plate preparatory to machining into

Fig. 1. By making both dies the same height, left- and right-hand stampings of skins for nose-wheel doors are produced simultaneously.

large integrally stiffened panels for Constellations. Some of the panels are 4 feet wide, 32 feet long, and 1 3/4 inches thick. Considerable difficulty had been encountered during machining as a result of the fabricating methods employed by the mill in producing heavy-gage aluminum plate to the required flatness.

Ordinarily, plate more than 1/2 inch thick is flattened after heat-treatment at the mill by a roll-leveling process. In working out the waviness produced by the heat-treatment, however, internal stresses are built up in the material. When the parts are machined, serious distortion occurs as the stressed areas are released, and

Fig. 2. Plastic dies were used to produce the landing-gear door skins in the initial test runs of the new press.



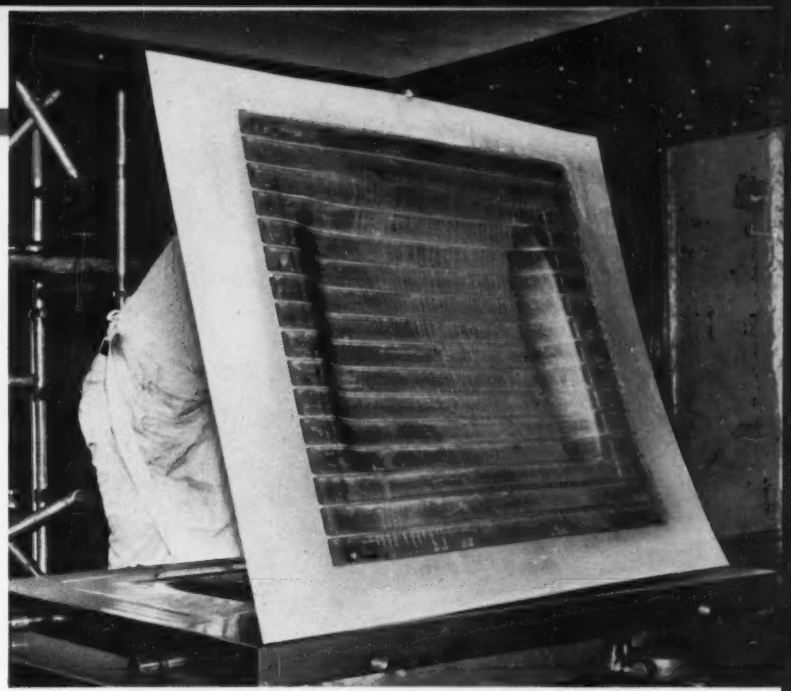


Fig. 3. The double contour of this integrally stiffened panel was formed by bulging.

correction procedures are time-consuming and costly.

Now, the plate is stretch-leveled on the Birdsboro press as it is received in the plant, and machining it into integrally stiffened skins is done with negligible resulting distortion. Special jaws have been designed that will grip the plate with sufficient intensity to permit a 2,000,000-pound stretching force to be applied. A special die is used, and a typical part—a 2- by 14-foot wing panel, 1 3/4 inches thick, for example—is elongated approximately 2 inches.

Integrally stiffened panels made from extruded materials flattened by roller or drawbench methods presented a similar problem when thin areas and bosses for attachment were machined. These parts also are successfully stretch-leveled on the new press. In these instances, provisions are made to prevent buckling of the skin web between the stiffeners as the result of the tendency of the part to "neck-in" when it is being elongated. This is being done in one of two ways—by incorporating spring-loaded pads in appropriate areas of the die, or by employing rollers to level the panel while it is under tension.

Vacuum Chucks Hold Large Aluminum Plates for High-Speed Milling

One-piece aluminum integrally stiffened skin panel members for aircraft have created problems with regard to methods of holding the workpieces during high-speed milling. Being made from a non-ferrous material, the parts cannot be held in magnetic chucks. Also, if the skins are clamped manually, their edges cannot be milled without repositioning the clamps.

These problems have been solved at the Lockheed plant by employing vacuum chucks. Skins 2 feet wide and up to 50 feet long are securely held on spar-milling machines with such chucks. Also, two solid aluminum panels, 4 feet wide, 32 feet long, and 1 3/4 inches thick can be gripped on the table of the Giddings & Lewis skin milling machine seen in Fig. 4. Since the skin mill operates at spindle speeds up to 3600 R.P.M., and removes as much as 600 cubic inches of metal per minute, the vacuum chucks must exert considerable holding power.

Vacuum chucks are of segmental construction —the larger chucks being made up of individual sections approximately 4 feet wide by 6 feet long, that are placed side by side and clamped to the table of the milling machine. This type of construction facilitates handling, and permits interchangeability of the sections between small and large chucks.

Each vacuum chuck section is made from 3/4-inch thick aluminum-alloy plate, with one 3/16-inch diameter hole (drilled vertically from the top surface of the chuck into a manifold) for every two square feet of chuck surface area, as seen in Fig. 5. The manifold, which is usually 1/2 inch in diameter, can be an integral part of the chuck plate (as shown) or be attached to the outside of the chuck. An air pump connected to

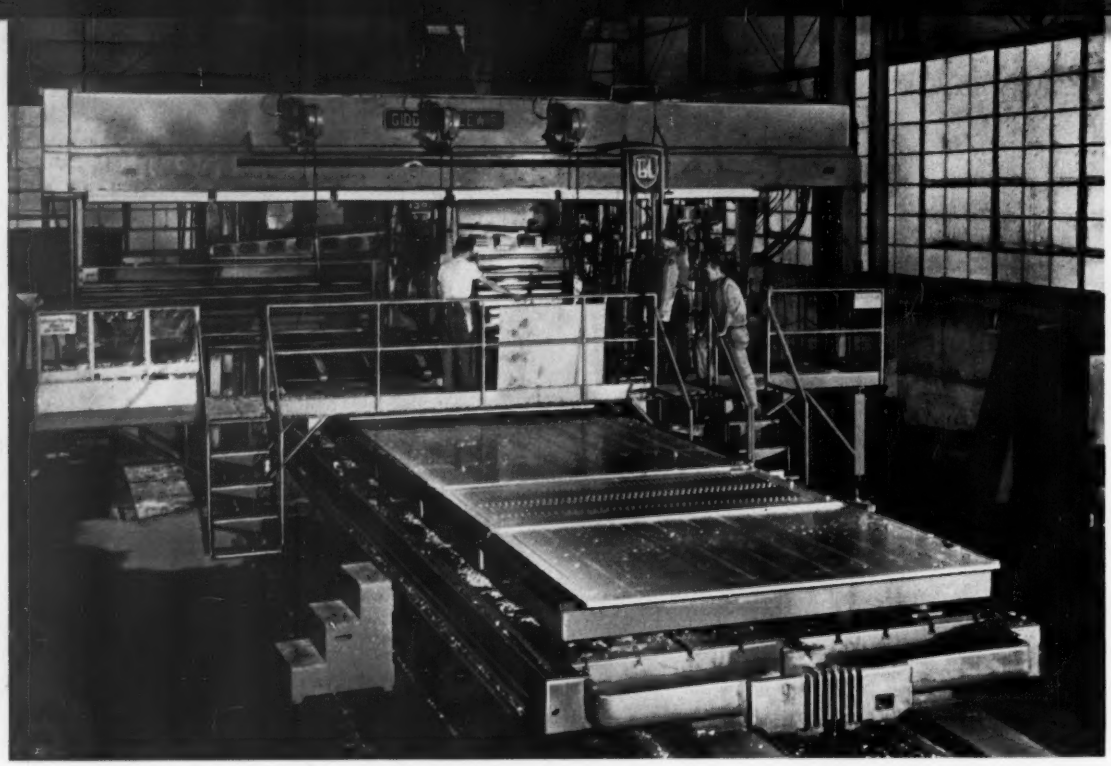
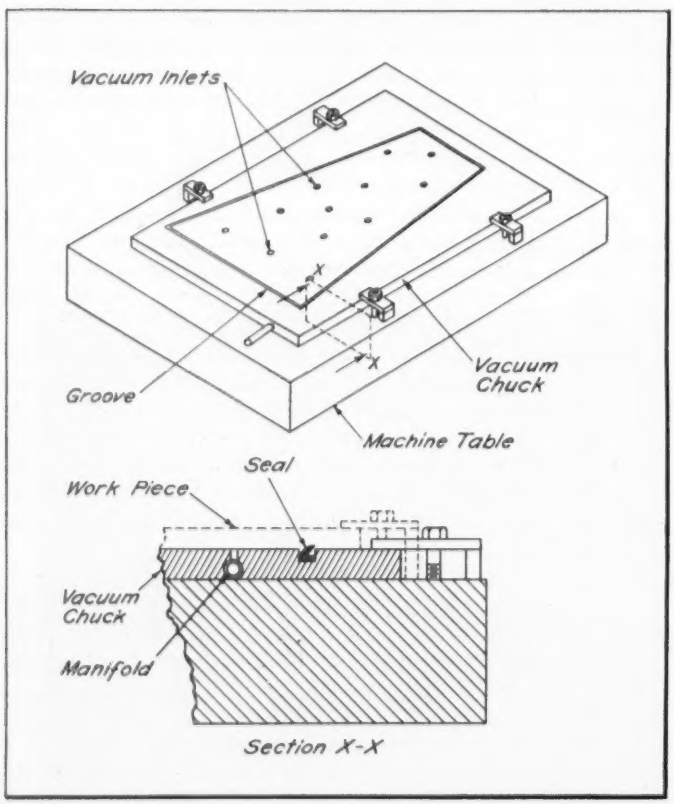


Fig. 4. Vacuum chucks provide ample gripping power for skin-milling operations. Aluminum, being non-ferrous, precludes the use of magnetic chucks.



this manifold must maintain a vacuum of at least 28 inches of mercury to secure the part.

Grooves are milled in the top surfaces of the chuck plates to conform to the configuration of the skin panel. Sealing rings, made from extruded neoprene or other oil-resistant rubber, are inserted in the milled slots, as seen in Fig. 6, with the under-cut side of the seal facing the outer edge of the part to be machined. The slots must be milled within close tolerances to insure a tight fit of the seal. Seals 7/16-inch wide are generally employed, but other sizes are used when required. Too wide a slot and seal should be avoided, especially when milling thin sheets, since such a condition allows the sheet to be pulled down into the slots, thus resulting in an uneven finished surface.

Fig. 5. Schematic drawing of a vacuum chuck secured to machine table by clamps. The seal is made from oil-resistant rubber.

Fig. 6. Inserting sealing rings in slots milled on top surface of vacuum chuck. Seals are generally 7/16 inch wide and a tight fit in slots.

In milling thick plates, where substantial residual stresses are released during cutting, the holding power of the vacuum chucks is supplemented by placing clamps around the outer edge of the work-piece, as seen in Fig. 7. In fact, whenever the part permits the use of such clamps without interfering with the milling operation, it is common practice to use the hold-down clamps as a safety measure.

Vacuum chucks in the plant are made from rolled or cast aluminum plates. Rolled plates have generally given better results, as the metal is less porous than a cast structure. However, the tendency of rolled plates to warp while they are being machined is a disadvantage. Also, cast plates are cheaper.

Surface finish on the tops of the vacuum chucks should not exceed 250 micro-inches r.m.s., although the finish on the part to be milled has some bearing on this requirement. Too fine a finish on mating surfaces of the chuck and work-piece may confine the vacuum to the areas immediately above and around the drilled holes (vacuum inlets), thus reducing the holding power of the chuck. This condition can be remedied by providing grooves approximately 0.010 inch deep, which extend radially in all directions from the vacuum inlet holes on the top surface of the chuck. Such grooves are generally required in vacuum chucks employed for milling thin sheets. Otherwise a rough finish will be produced.

The table of the milling machine must be cleaned after each operation, as any chips entering the vacuum inlets will reduce the holding power of the chuck. A trap and a tank are provided for collecting coolant that enters the manifolds, thus preventing it from entering and contaminating the air pump. Also, a self-winding reel is employed to provide a flexible connection between the air pump and the reciprocating table of the milling machine.

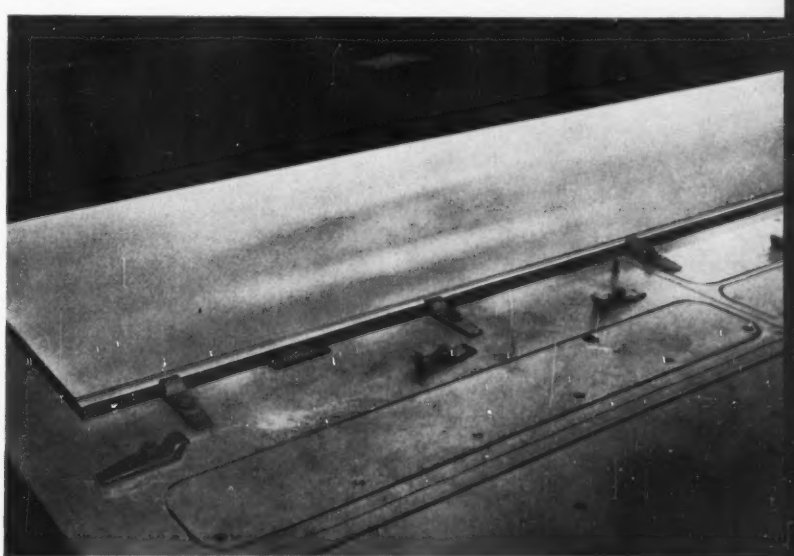


Fig. 7. Sealed-off vacuum inlets are seen in foreground. In milling thick plates, vacuum holding is supplemented by clamping.

Jet-Engine Aft Frames by

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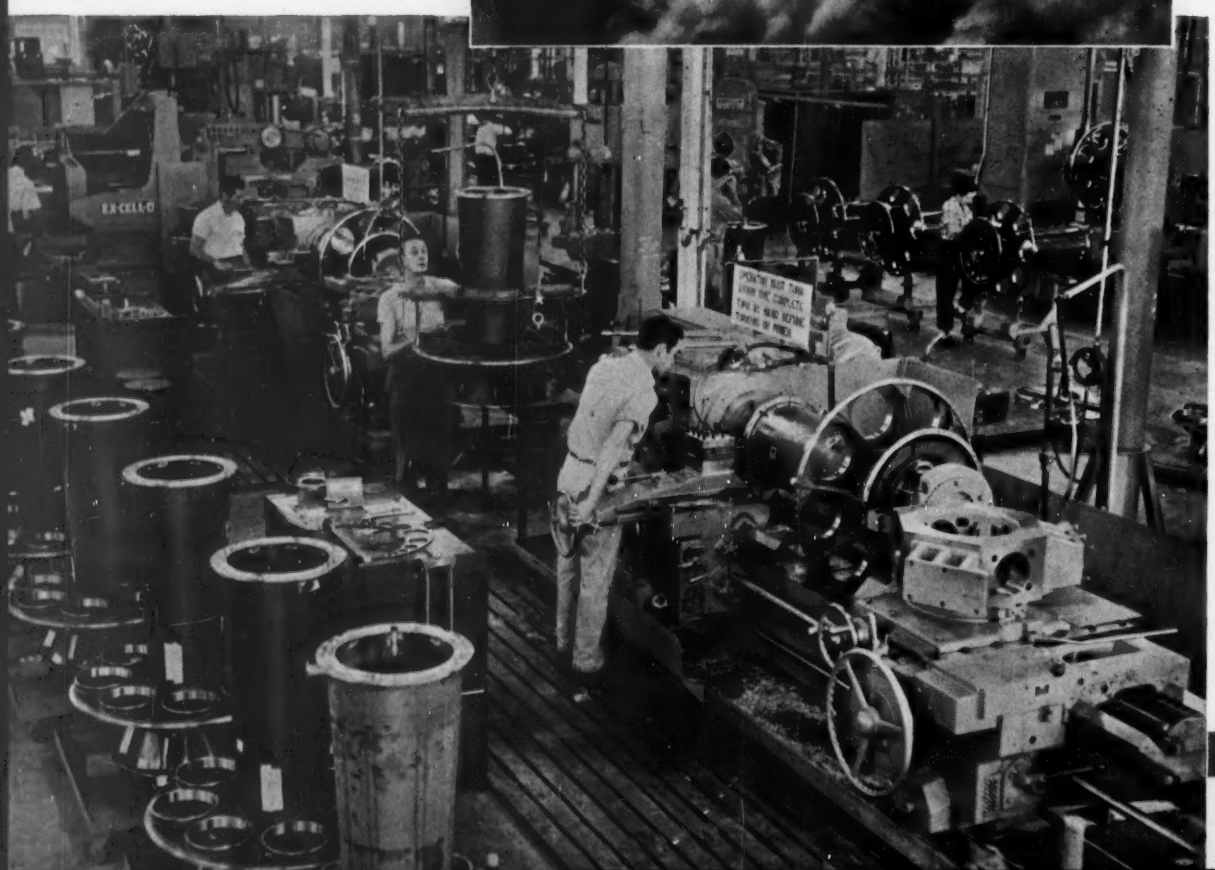
Boeing B-47 Stratojet Bomber



Ryan Production Methods

ONE of the most important components of a jet engine is the aft frame, which holds the combustion chambers, transition liners, turbine cases, and compressor cases in one assembled unit. The aft frame also contains the housings for two of the main bearings of the high-speed turbine-compressor shaft. The aft frame can well be considered the backbone of the "hot" end of a jet engine.

Aft frames for the General Electric J-47 jet engines are completely fabricated from 18-8 type stainless steel and machined within extremely close tolerances for a structural part in a building recently constructed by the Ryan Aeronautical Co. These aft frames are considered one of the most complex stainless-steel products of a plant that has long specialized in the production of weldments for the aircraft industry.

In configuration, the aft frame consists of a slightly tapered cylinder, to which are welded a number of heavy-gage machined flanges, and a large circular burner plate. Eight flanged eyelets in the burner plate receive the combustion chambers and hold them in accurate alignment. Over 150 feet of high-quality welding is performed in fabricating each aft frame. Approximately 64 feet of electric seam-welding is performed in making the tapered cylinder, and 75 feet of metallic arc welding is necessary to attach the flanges to the barrel and join other details.

Welding widths must be controlled within 1/16 inch and parent metals must be penetrated at least 20 per cent of their thickness—in some cases 100 per cent. The difficulties encountered because of these specifications may be appreciated from the fact that seams are made regularly between sheets 1/16 and 3/8 inch thick. Extreme care is necessary to insure proper penetration and to avoid undue distortion or cracks caused by varying rates of heat dissipation in sheets of different thicknesses.

Upon completion of the welding operations, the aft frames are heat-treated to remove the residual strains caused by welding. The heat-treating is performed in a huge General Electric furnace. Heating and cooling cycles are carefully regulated over a sixteen-hour period. A controlled atmosphere in the furnace prevents oxidation during the heat-treatment.

In the machining operations that follow heat-treating, total tolerances are held as close as 0.001 inch on the smaller diameters, 0.002 inch on a diameter, say, of 15 inches, and 0.02 inch on a length of 44 inches. Most surfaces are finished to a smoothness of 63 micro-inches r.m.s.

The first machining operation on the aft frames is performed on a Bullard 54-inch Cut Master vertical turret lathe equipped as illustrated in Fig. 1. Tools on the turret rough-machine surface *A* of the bearing housing and shoulder *B*, and bore holes *C* and *D* (see Fig. 2). At the same time, tools on the side-head turn and face the rear flange *E*, Fig. 1, and also face the burner plate flange *F* on both sides and turn the burner plate flange.

Tungsten-carbide tools are used exclusively in this and all succeeding operations. The conical section of the aft frame is enclosed by a structural fixture which is provided with three locating blocks that are entered into the eyelets for radial locating purposes. The fixture adequately supports the work both on the forward flange and on the eyelet flanges. The triangular locators in the eyelets are provided with small adjustable blocks that are tightened against the eyelet flanges by means of Valear screws. These screws are set to provide a predetermined pressure that eliminates any distortion from clamping. After the predetermined pressure has been obtained, further adjustment of the screws has no effect on their tension.

The aft frames are next transferred to the Bullard 64-inch Cut Master vertical turret lathe illustrated in Fig. 3, which is equipped for rough-facing and boring rabbet *G* on the forward end, rough-turning the outside diameter of the rabbet, rough-facing surfaces *H* and *J* of the forward flange, and turning flange periphery *K*. Facing of surface *J*, as well as turning and under-cutting of the flange, is performed by a cutter on the side-head.

In this operation, the aft frame is accurately located from the previously machined rear flange

Fig. 1. Vertical turret lathe set-up for performing various rough-facing, boring, and turning cuts on rear end of aft frames

and from two lugs that were also turned in the previous operation. The work-fixture has vertical posts on which an upper section is positioned after the work has been seated on the bottom of the fixture. This upper section is provided with three sliding blocks that are adjusted against the tapered cylinder of the aft frame. These sliding blocks are tightened against the work by means of Valear screws to insure a predetermined pressure.

One of the most unusual machines in the aft frame production line is the Ex-Cell-O precision boring machine shown in Fig. 4. The aft frames reach this machine after an interim of sixteen to twenty-four hours following the second Bullard operation. A seasoning period of that length of time tends to reduce distortion in the subsequent finishing operations.

The aft frame is conveniently dropped into a cradle on the Ex-Cell-O machine by means of an overhead air hoist suspended from a crane. The part is located lengthwise from the rough-faced flange of the burner plate, which is clamped against locating pins. An expanding plug is entered into the bearing housing from the right-hand end of the machine to insure axial location. Then, the operator presses buttons to actuate

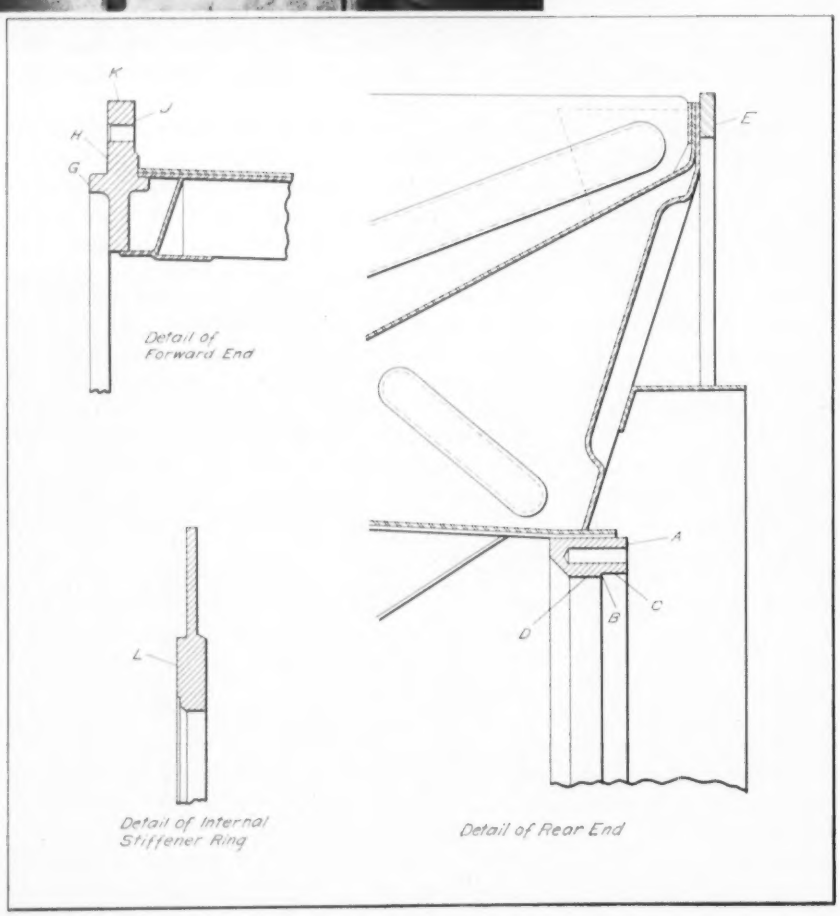


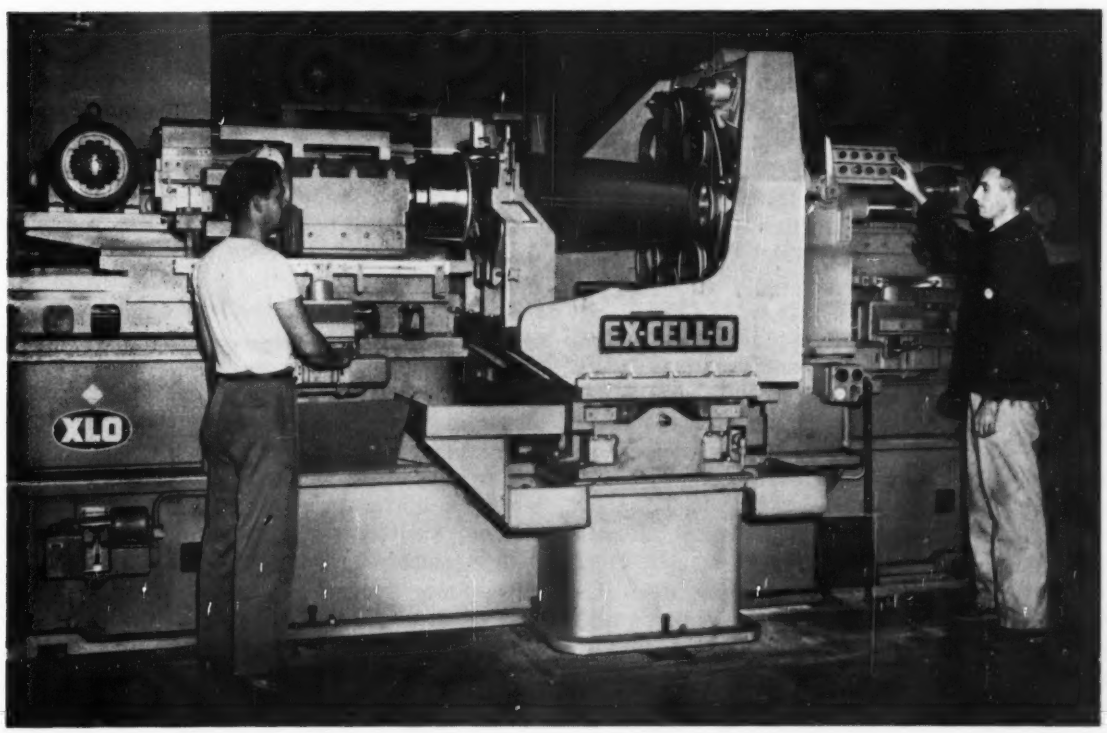
Fig. 2. Detail drawings that indicate surfaces machined on vertical turret lathe

Fig. 3. Rabbet and other surfaces on the forward end are rough-machined by tools mounted on turret and side-head of lathe

hydraulic clamps that securely hold the part in position, after which the expanding line-up plug is retracted.

"Snap-Lock" micro switches on the clamps and on the line-up plug must be tripped before the machine can function. In an operation, the front cutter-head on the left-hand side of the machine—seen in line with the work in Fig. 5—moves forward for finish boring and facing the forward flange. Upon the completion of these cuts, the cutter-head retracts, after which the entire cradle assembly slides toward the back of the machine to bring the aft frame into line with the cutter seen at the left in Fig. 5 and with the cutter illustrated in Fig. 6. The rear cutter-head on the left-hand end of the machine bores, counterbores, chamfers, and faces a stiffener bearing flange *L*, Fig. 2, which is inside of the barrel of

Fig. 4. Precision-boring machine of special design used for finishing circular surfaces at both ends of the aft frame and on the stiffener flange near center of tapered barrel



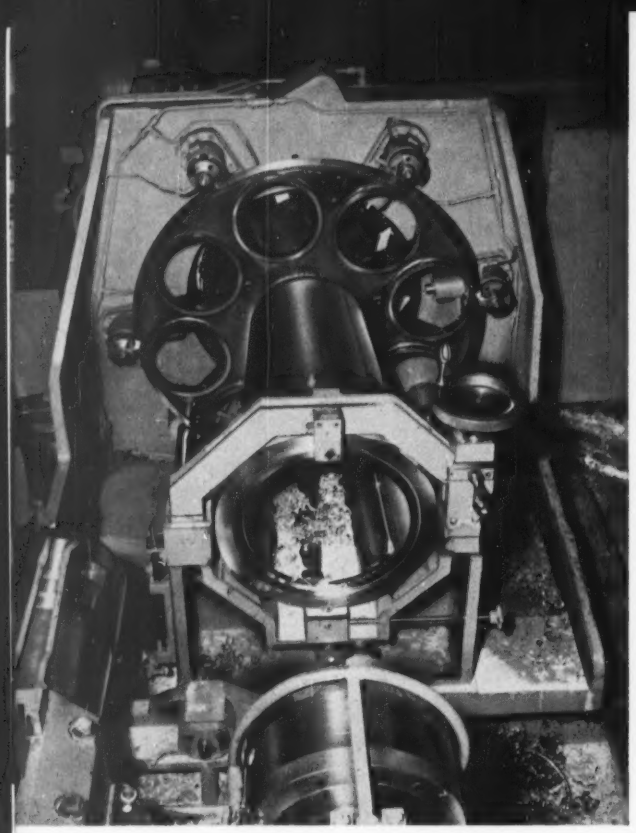


Fig. 5. View of the precision-boring machine taken from the left-hand end to illustrate two of the cutter-heads

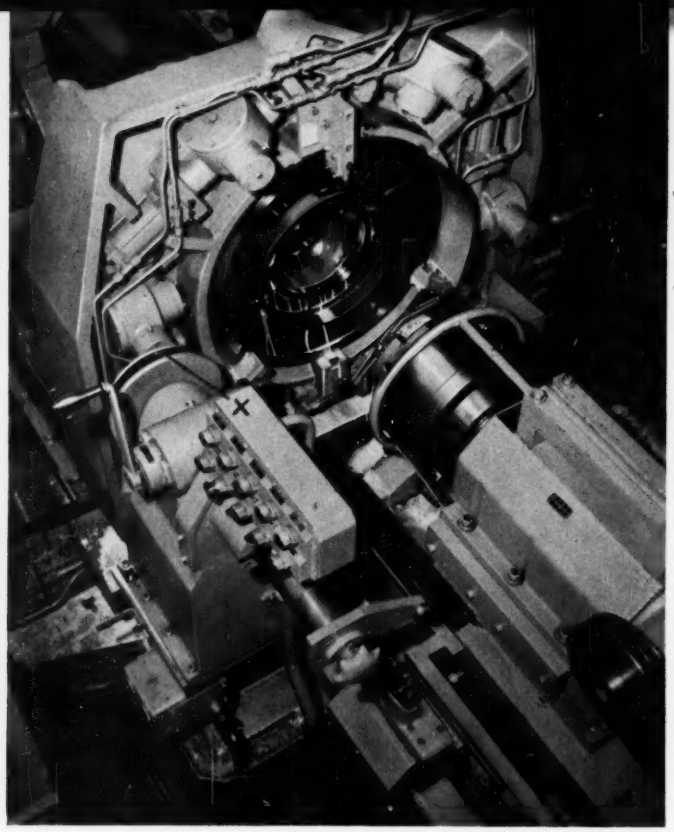


Fig. 6. View of cutter-head on right-hand end of precision-boring machine and of tapered line-up plug

the aft frame at a distance of approximately 17 inches from the forward end.

The cutter-head on the right-hand end of the machine bores, counterbores, and faces the aft bearing housing. When these cuts have been completed, both cutter-heads retract and the cradle returns to the front of the machine. Incidentally, the line-up plug used for axial location of the aft frame is seen at *X* in Fig. 6.

The three cutter-heads on this machine are equipped with a total of thirteen tungsten-carbide tools, and the heads are powered by individual 5-H.P. motors. Each cutter-head is operated under hydraulic pressure supplied by Vickers equipment. An ingenious cam-operated mechanism is provided on each cutter-head for actuating the cutting tools.

Two of the cutter-heads are equipped with a circular pipe having a series of small holes through which a spray coolant is supplied during actual cutting. The third cutter-head, which machines the internal flange surfaces, is provided with longitudinal pipes that deliver coolant directly to the individual cutters of that head.

American and Cincinnati Gilbert radial drilling machines equipped with ingenious cutter-heads, as shown in Figs. 7 and 8, are employed for the precision boring, turning, facing, and under-cutting of the eight eyelets provided in the aft frame to support the combustion chambers. The vertical spindle of the boring-head is actually a shaft within a shaft, the central shaft being joined directly to the spindle of the radial drilling machine by means of a shear pin. At the bottom end, the boring-head spindle is equipped with a cutter-head that is fitted with four sets of dual carbide-tipped tools. Each pair includes a roughing and a finishing tool. The work-fixture is a heavy iron casting provided with an upper section that can be radially indexed on ball bearings in order to bring it to successive eyelets under the cutter-head. The construction of the fixture can be readily observed from the machine in the foreground of Fig. 7, which is illustrated without an aft frame in position.

In operation, the boring-head spindle, driven from the machine spindle, rotates and automatically feeds the boring-head downward. The first

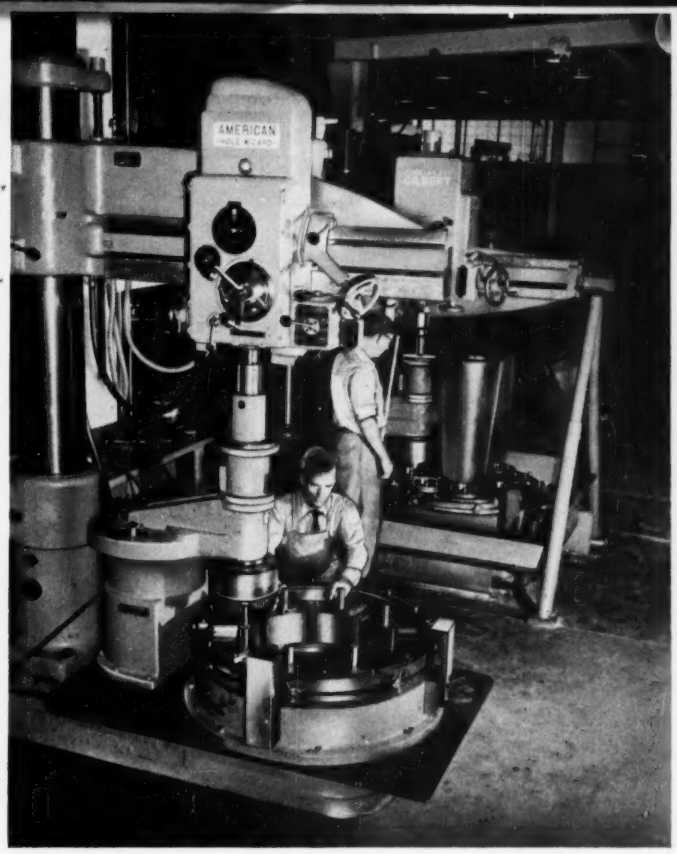


Fig. 7. Two radial drilling machines each equipped with a special cutter-head for taking various cuts on the eyelets of frames

Fig. 8. Close-up view of special cutter-head equipped with four sets of dual cutters for finish-machining four different surfaces

pair of cutters bores the inside of the eyelet flange. Then, after this cut is completed, further descent of the cutter-head brings the second pair of cutters into action to turn the outside diameter of the eyelet. When this turning step is completed, the downward movement of the outer shaft of the boring-head is stopped by a pilot. However, as the inner shaft continues to descend, bellcranks are operated, causing the third pair of cutters to move outward horizontally for facing the top of the eyelet flange. Finally, the fourth set of cutters is brought into play by cam action to under-cut the eyelet flange to a bevel.

Since each step in the operation follows in rapid sequence, exact timing of all movements is necessary. This timing is obtained by a special Ryan-designed system of pins that engage grooves in the shafts to coordinate the motion of all cutter-head parts.

The cycle of operation is completely automatic except for loading and unloading the work and indexing the aft frame. Air hoists on overhead cranes facilitate loading and unloading. Also, the radial arm of the drilling machine, together with the boring-head, is easily swung out of the way to facilitate the loading and removal of work.

Each aft frame can be finished by one of these radial drilling machines within two hours—which is only 10 per cent of the time that was required when the operations were performed on another type of machine tool provided with conventional tools. The total investment for each machine set-up is about 50 per cent of that spent previously. The bored finish of the eyelets must be within 125 micro-inches r.m.s.

For the operation on the Warner & Swasey gap type turret lathe shown in Fig. 9, the aft frame is mounted on a heavy mandrel, which is provided with a flange at one end having a 10-degree tapered surface that is registered with the inside circular surface of the rabbet on the forward flange. The opposite end of the mandrel is provided with a tapered plug that is engaged with the bored hole in the bearing housing for locating purposes. The major portion of the mandrel between the locating sections is covered with leather to protect the internal surfaces of the aft frame against damage.

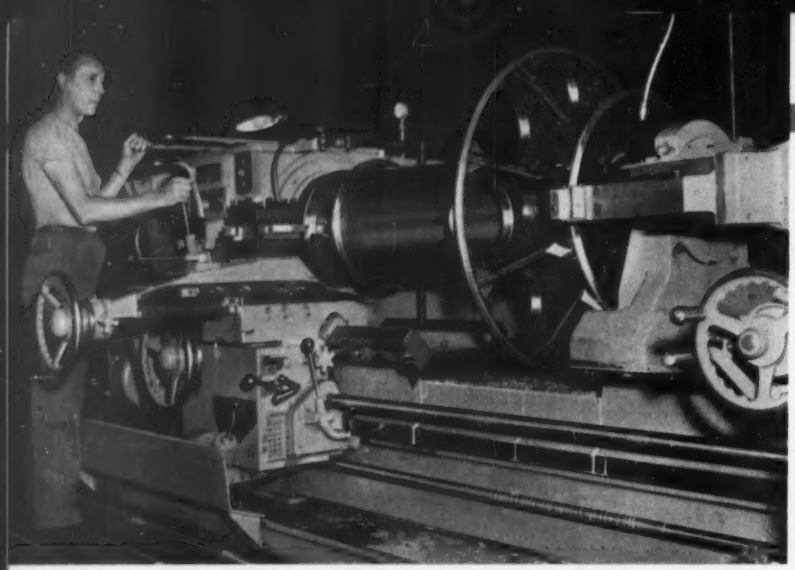


Fig. 9. Various surfaces of three different flanges of the aft frame are finish-machined on this gap type turret lathe. The work is supported on a heavy leather-covered mandrel

Fig. 10. Tungsten-carbide cutters on the cross-slide take various facing and turning cuts on the forward end of the aft frame.

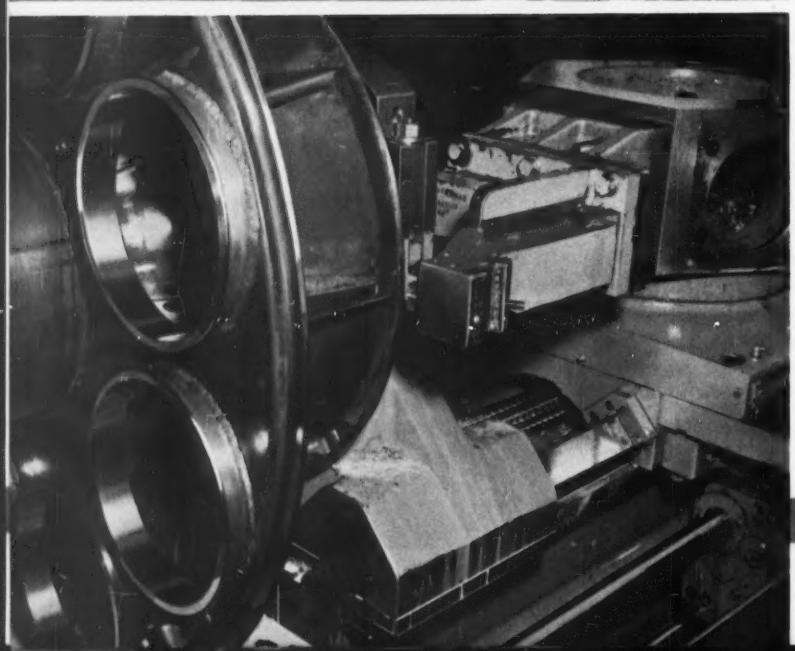


Fig. 11. Tungsten-carbide tools which are mounted on two arms attached to the turret take turning and facing cuts on the adapter plate and burner plate flanges.

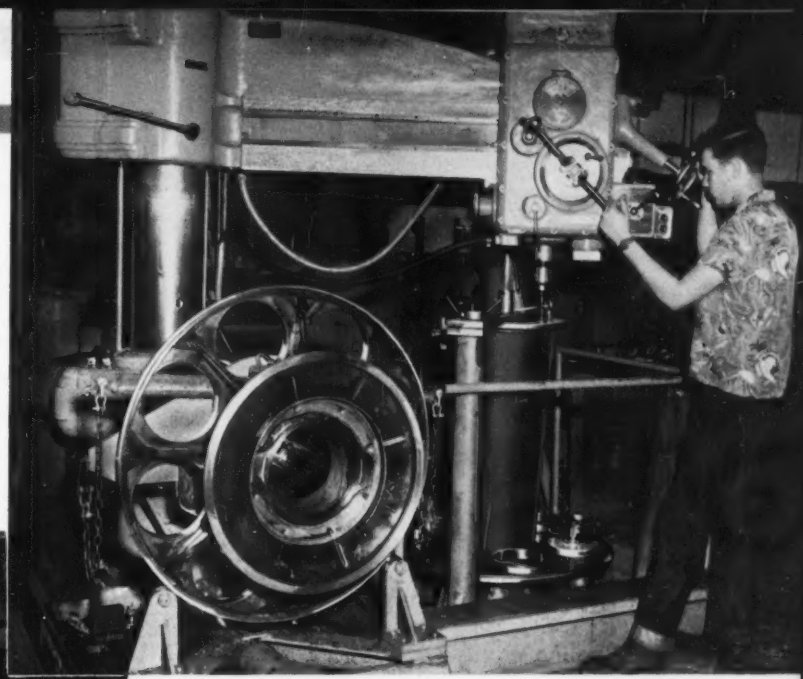


Fig. 12. Radial drilling machine equipped with horizontal and vertical fixtures to facilitate the performance of various detail operations by one machine

In this turret lathe operation, tools on the front slide take finish facing and turning cuts on the forward flange of the aft frame, Fig. 10. Tools provided on two arms mounted on the turret finish face and turn the adapter plate and burner plate flanges. A tool on one of these turret arms is shown in Fig. 11.

Two fixtures are mounted on the American radial drilling machine illustrated in Fig. 12 to permit a series of drilling and end-milling operations to be performed on aft frames. They are first placed in the horizontal fixture and then in the vertical fixture. A 1-inch end-mill is used to cut two grooves in the periphery of the forward flange. In subsequent operations, these grooves are used for locating. The horizontal fixture has rollers for easy indexing.

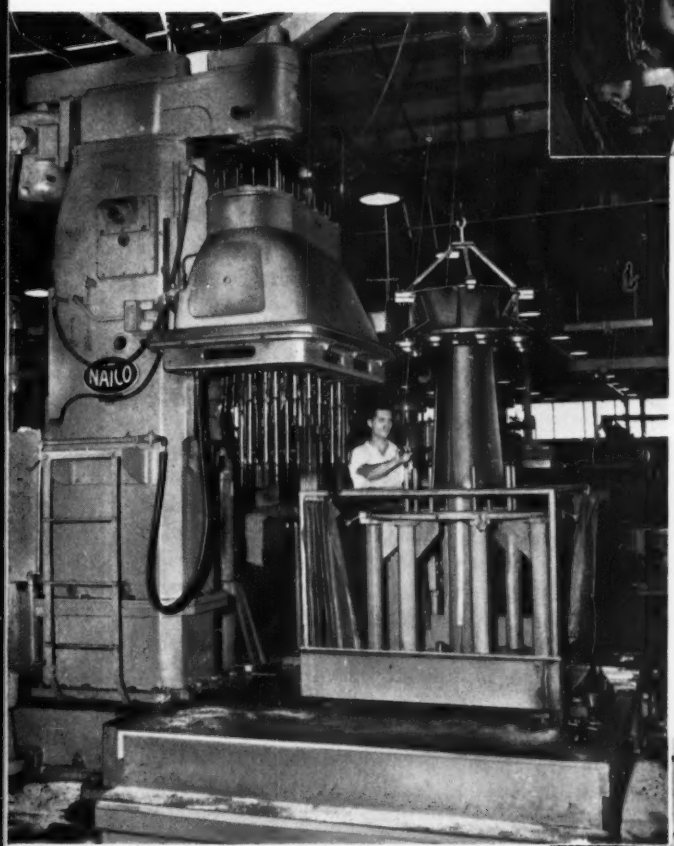


Fig. 13. (Above) Radial drilling machine employed for drilling a total of 160 holes in aft frames equipped with a fixture slide that facilitates reloading

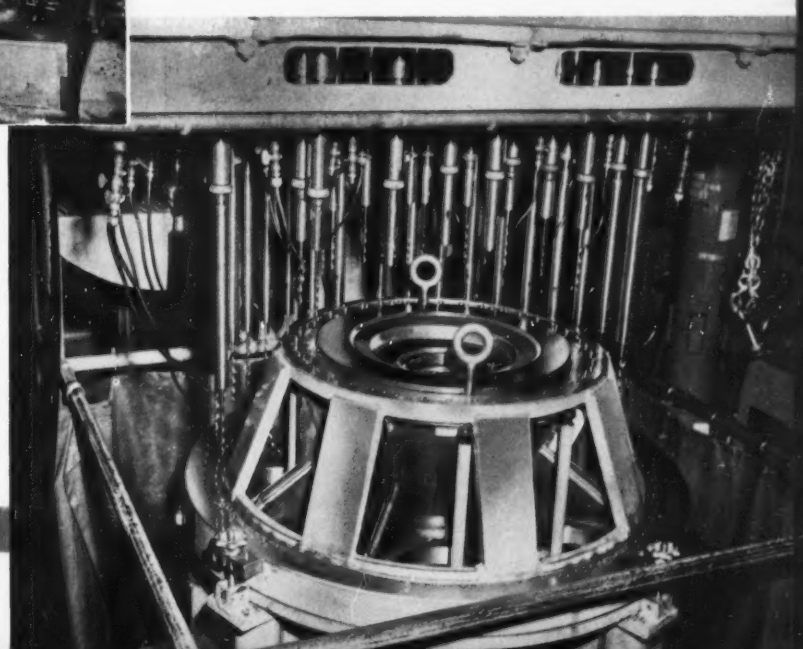


Fig. 14. (Right) Close-up view of the drills provided on the machine shown in Fig. 13 for producing 160 holes in four indexings of the work

Fig. 15. Precision tapping machine used for tapping to Class 3 fits a large number of holes in the flanges of aft frames

A total of 160 holes are drilled in the burner plate, adapter flange, and bearing housing flange by the Natco multiple-spindle drilling machine illustrated in Figs. 13 and 14. Forty holes are drilled at one time with the center-to-center distances maintained within a total tolerance of 0.01 inch. It is necessary to index the aft frame four times in order to drill all the holes. What was formerly a three-hour drilling job has been cut to fifteen minutes with this equipment.

As shown in Fig. 13, the work-fixture is mounted on a slide that can be moved to the front of the base from under the drilling head to facilitate reloading of work. Valear screws are tightened against the burner plate flange for exact location of the work, and then clamping blocks are tightened against the flange.

Tapping of sixteen holes in the bearing housing face is accomplished with the Warner & Swasey machine shown in Fig. 15. Taps of a special design suitable for the threading of blind holes in stainless steel are used, these taps having been developed by the Threadwell Tap & Die Co. They are made with only two flutes and with a negative-rake cutting angle. The taps are 1/4 inch in diameter and have 28 threads per inch. All holes are tapped to a Class 3 fit.

After this tapping operation on the housing, the aft frame is turned end for end on the table of the machine. Then, fourteen holes (No. 10–32 threads per inch) are tapped in the forward flange. In addition, two holes of 3/8-inch diameter are tapped in the same flange.

The aft frames are next transferred to another Warner & Swasey gap type turret lathe for finishing operations. A final cut is taken on the outside diameter of the rabbet on the forward flange, this dimension being held to size within a total tolerance of 0.002 inch. The forward flange is also finish-faced, both cuts being taken by tools on the front slide. A master meas-

Fig. 16. Drilling, boring, and milling machine employed for performing a number of detail milling, drilling, and tapping operations on the jet-engine aft frame

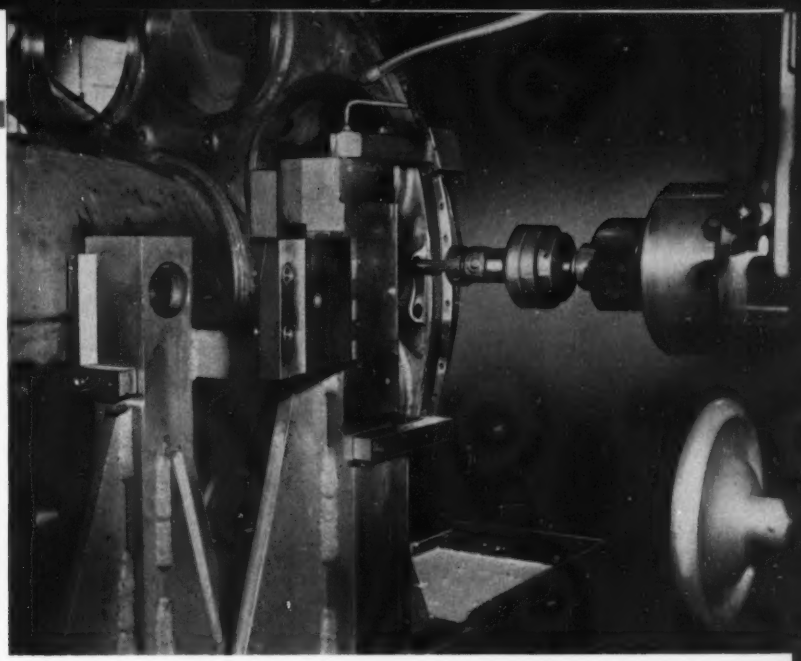


Fig. 17. Close-up view of the boring mill, showing the machine being used for tapping a hole in a mounting pad

uring bar and dial gages are kept adjacent to this machine for reference purposes so as to insure that final dimensions of aft frames will be in accordance with the room temperature at the time that the frame was in the turret lathe.

Another final machining operation is performed on the Cincinnati Gilbert drilling, boring, and milling machine shown in Fig. 16. This operation consists of milling the faces of the mounting bracket pad, drilling two holes in the pad, countersinking the holes, and finally tapping the holes as illustrated in Fig. 17. The holes are tapped to 1/2-inch diameter, 13 threads per inch, and a Class 3 fit is specified.

Upon the completion of all machining operations, the aft frames are cleaned of chips and other extraneous material by vibration. For this purpose, each aft frame is clamped to a base that is fitted with two cylinders and oscillating pistons actuated by compressed air. The aft frame is vibrated at high frequency to shake out all foreign matter. Oil and grease are removed by immersing the aft frames in a trichlorethylene vapor bath.

Each aft frame is finally given a thorough check to insure that important dimensions are within specified limits. In Fig. 18 is seen an aft frame set up for final inspection. Federal Testmasters are employed for checking circular surfaces for concentricity, the aft frame being rotatable on bearings of the inspection fixture. The dial gages are attached to magnetic blocks so that they can be conveniently positioned anywhere on the table or fixture to meet the preference of the inspector. The magnets hold the gages firmly in established positions until they are forcibly moved. Two dial indicators mounted on a bar are entered into the interior of the aft frame for checking the bore of the stiffener bearing. The stiffener bearing is located near the middle of the component.

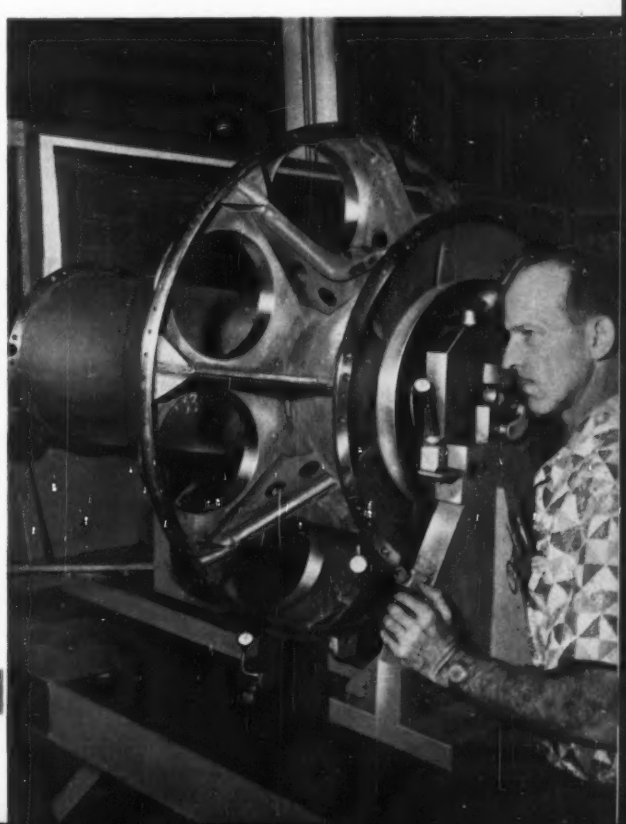


Fig. 18. For concentricity inspection, use is made of dial gages attached to magnetic blocks that can be positioned on the table or fixture to suit preference of inspector.

Working.

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North American F-86 Sabrejet

Titanium at North American

SUBSTANTIAL quantities of titanium, both commercially pure and in alloy form, were made available to the aircraft industry at the precise time when aircraft design engineers were badly in need of such a material. Higher airplane operating temperatures, due both to higher air speeds and to fuselage-enclosed jet-engine installations, had reached a point where the mechanical properties and heat resistance of the high-strength aluminum alloys were seriously threatened.

For some time it seemed that stainless steel or some other high-alloy critical steel would have to be used. However, the substitution of such alloys for aluminum would have involved a tremendous sacrifice in weight advantage, an all-important factor in aircraft design. Then along came titanium and its alloys, offering a degree of heat resistance exceeding all immediate requirements, corrosion resistance approaching that of platinum, and a strength-weight ratio at moderately elevated temperatures substantially better than stainless steel.

The advent of titanium concurring with the need for such a material was extremely fortunate, but involved several serious drawbacks. Availability and need were so closely spaced that no intervening period existed during which proper, routine investigations could be made into the many fabricating problems attendant to the use of any new material. Secondly, the cost of titanium (currently about $20 a pound) and its limited availability made it impractical to proceed with the usual trial runs, which waste a large amount of material.

As a result of these limitations, few standards of production have been established, and it is doubtful if any two companies employ the same production techniques. Instead, each aircraft company has developed stop-gap production procedures that will produce an acceptable part. However, investigations are being conducted to improve the processes and techniques now in use, or to develop entirely different techniques. Meanwhile, acceptable parts are being produced.

At North American Aviation, Inc., up to 600 pounds of titanium parts are being used in production models of jet fighter airplanes. Most of these parts are concentrated in the rear section of the fuselage to resist the high heat generated by the fuselage-enclosed jet engine. Both structural and non-structural parts are being produced in compliance with strict military specifications.

Sheet stock, bar stock, and forgings in the commercially pure and alloy forms are being used. Extruded parts, castings, and tubing are not being used at this time. The fabricating processes being employed for titanium include machining and extensive forming operations, with some resistance welding on non-structural components.

The purpose of this article is to point out how North American employs these various titanium fabricating processes. The data may not correspond with practices followed by other users of this metal, but research is proceeding on all phases of production in an attempt to improve and gather additional information on the working of titanium.

In the aircraft industry, most machining operations are extremely critical due to the narrow tolerances demanded on the majority of parts. Generally speaking, the machinability of titanium compares with that of Inconel X, and is slightly more difficult to machine than AISI Type 347 stainless steel. To prevent overheating and work hardening of the titanium, it is essential to use sharp tools, adequate support for the work, good coolants, and a steady feed. Although carbide tools can be used to cut titanium, high-cobalt tool steels have proved to be superior in some respects. The carbide tools have a tendency to chip, and require more frequent sharpening, especially on intermittent cuts.

When machining titanium, rather substantial depths of cut should be taken. In attempting to make a shallow cut, the tool would have a tendency to rise and ride on the surface of the material. Slightly less rake should be used than when

machining Type 347 stainless steel. Although no pre-machining preparation of sheet or bar stock is necessary, forgings of titanium must have all of their scale removed before any machining operations are attempted.

The feed employed for rough-machining is not critical, and can vary from 0.012 to 0.050 inch per revolution. In finish-machining, the feed should be about 0.008 inch per revolution. Lathe speeds for rough-machining can vary from 30 to 65 feet per minute, but for finish-turning can be increased to between 150 and 350 feet per minute. These cutting speeds apply to titanium alloys only. When machining commercially pure titanium, the cutting speed should be from 20 to 30 surface feet per minute.

Either conventional soluble cutting oils or carbon-dioxide gas may be used as a coolant. Fine titanium chips can be ignited, and titanium dust suspended in air is explosive. The same precautions should be employed as when machining magnesium.

In grinding, titanium has a tendency to smear and weld to hard abrasive grinding wheels. For this reason, soft abrasive wheels are generally used, and are operated at surface speeds ranging between 2000 and 3000 feet per minute.

In cut-off work, heavy coarse saws have been found most satisfactory. At North American, the saws used average 1/16 inch in thickness and have two teeth per inch. Abrasive cut-off wheels have also been found to work very well. When cutting sheet stock, ordinary shop saws are satisfactory with thin material, but nibblers work better on thicker sheets.

All of the titanium forgings used at North American are purchased from outside forging shops, but strict liaison between the vendor and the company's process engineering department is maintained. In forging titanium, there is great danger of excessive grain growth and surface cracks. All phases of the process must be rigidly controlled. The mere fact that a forging completely fills the die cavity is no indication that it will be acceptable for aircraft use.

Welding of titanium is as yet a questionable process, though a great deal of research is being done with several welding and brazing processes. At North American, resistance welding is the only welding process accomplished on a production basis, and this only on non-structural parts made from commercially pure titanium. The Sciaky resistance welding machine shown in the heading illustration is being employed to spot-weld hat sections (formed from commercially pure titanium sheets) to a titanium sheet.

The welding of titanium to dissimilar metals is still in the experimental stage. Arc welding and

Fig. 1. Hot-forming titanium sheet on a Cincinnati press brake. The sheets are heated in the electric furnace at right. Operators wear asbestos gloves.

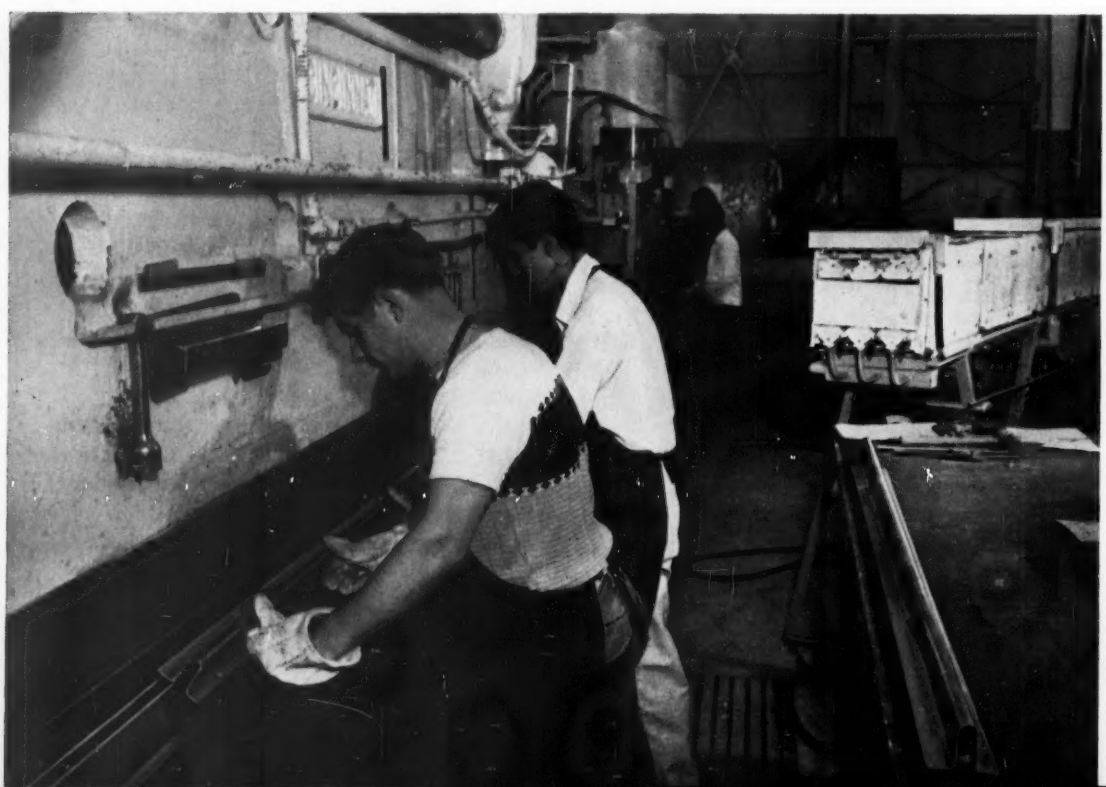


Fig. 2. Forming commercially pure titanium sheet at room temperature on a punch press. Excessive springback of material complicates die design.

inert-gas welding of the metal are also in the experimental phase. Welds produced by either of these methods are extremely brittle, making it impossible to determine their strength.

Parts have been successfully formed from titanium using power press brakes, hydraulic presses, stretch presses, power hammers, drop-hammers, punch presses, arbor presses, and forming rolls. The most prevalent difficulties stem from the metal's limited ductility, which reduces the rate of forming, and the poor capacity for shrinkage. The forming characteristics of commercially pure titanium can, in general, be compared to quarter-hard stainless steel, and present alloys to half-hard stainless steel.

Cold-forming should be employed whenever possible. In cold-forming titanium, greater pressures are required than in low-carbon steels, and slower press speeds are desirable. The work-hardenable characteristic of titanium makes annealing necessary when production of a part involves repetitive severe stressing. This is accomplished by heating the material for approximately twenty minutes at a temperature of 1050 degrees F. A stress-relieving heat-treatment is

Fig. 3. Rubber pad forming of commercially pure titanium at room temperature on hydraulic press. Pressures of 3500 pounds per square inch and above are used.

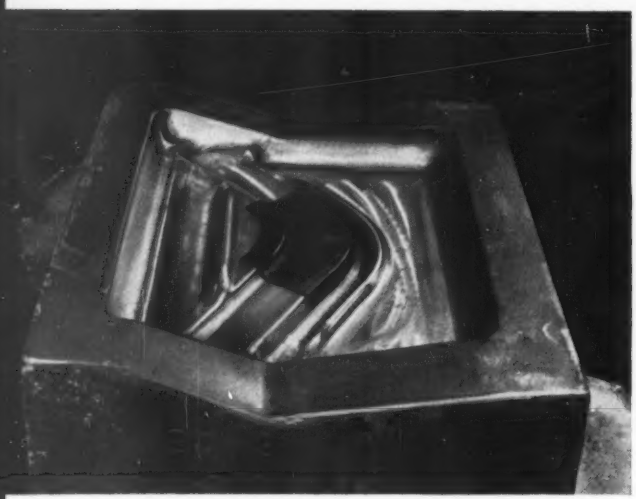


Fig. 4. Commercially pure titanium sheet after it has been heated to a temperature of 800 degrees F. and formed in drop-hammer

also employed after forming to eliminate the danger of cracking. Stress-relieving consists of heating the material for thirty to sixty minutes at a temperature of between 700 and 1000 degrees F., the exact temperature depending upon the conditions involved. Warpage from annealing and stress-relieving has not been a problem.

Titanium can be formed much easier when heated—to a temperature of 800 degrees F. for commercially pure titanium, and 1000 degrees F. for alloys. Hot-forming has provided a solution to troublesome problems where cold-forming has failed. However, hot-forming is impractical when using certain types of equipment. At North American, hot-forming is done on hydraulic presses and drop-hammers. Both hot- and cold-forming are performed on power brakes, punch presses, and power hammers.

Temperatures above 1000 degrees F. should be avoided due to the danger of embrittlement. Preheating of the dies or forming tools is desirable to avoid an abrupt loss of heat in the metal to be formed. Petroleum base lubricants have not proved too successful for hot-forming because of the high temperatures. Johnson's wax lubricants may be used with die temperatures up to 470 degrees F., and Clorafin has given satisfactory results. Dry lubricants, such as graphite or molybdenum disulphide, and phosphate coatings are being considered for application.

In forming titanium on power press brakes, operations are similar to those used for half-hard stainless steel. Designs of press brake formed aircraft parts are based on a minimum

Fig. 5. Heat is essential to avoid fractures in severely forming titanium sheet under the drop-hammer. Electric oven for heating material is seen at right.

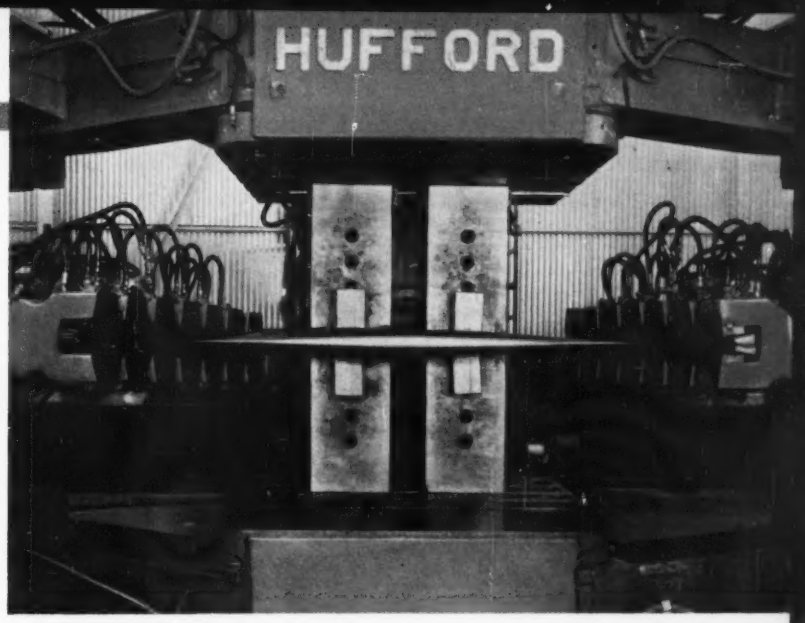


Fig. 6. Hufford stretch-wrap forming machine equipped with Hydra-Curve jaws for stretch-forming commercially pure titanium sheet at room temperature

bend radius of three times the sheet thickness. Hot-forming is only used after cold-forming has been unsuccessful. An example of hot-forming on a Cincinnati press brake is illustrated in Fig. 1.

Cold-forming of titanium parts on a punch press is seen in Fig. 2. Excessive spring-back (approximately 7 to 14 degrees for titanium alloys) makes die design difficult. Slow, uninterrupted ram speeds are essential for deep-drawing or acute flange forming. Rubber pad forming on a hydraulic press, Fig. 3, can be performed at high pressures (3500 pounds per square inch and above) on thin titanium sheets.

In forming titanium on drop-hammers, Fig. 5, more operations are required than for forming Type 347 stainless steel to a similar contour. Heat is essential to avoid fractures in severly forming titanium on the drop-hammer. Heat-resistant rubber is more desirable, since asbestos blankets are unsatisfactory. Also, hard-faced Kirksite dies with tool-steel or flame-hardened plow-steel inserts are recommended, because conventional Kirksite hammer dies may be injured by the heat. Currently, work is in progress to develop a more satisfactory hammer die material. A commercially pure titanium sheet that has been heated to a temperature of 800 degrees F. and formed under a drop-hammer is seen in the die in Fig. 4.

Titanium and titanium alloys seem to be suited for cold-stretching, a typical operation being shown in Fig. 6. Slow, uniform cycles are desirable, and the generally recommended maximum stretch is 20 per cent—although 30 per cent has been obtained. Necking is a critical and serious problem, and unsatisfactory results in stretching may be due to inclusions and laminations in the material. Steel forming dies are more desirable than Kirksite when heat is required in stretching operations. In stretch-press work, spring-back of commercially pure titanium is comparable to that of half-hard stainless steel, but considerably more when stretching titanium alloys.

The Hufford stretch-wrap forming machine seen in Fig. 6 is being employed on commercially pure titanium sheet at room temperature. The machine is equipped with Hydra-Curve sheet jaws, permitting extreme curvature possibilities. In installing parts made from titanium sheet on the airplane, Monel metal rivets are generally used. The galvanic corrosion tendencies of titanium parallel those of stainless steel, and are worse when the metal is in contact with aluminum or magnesium. In galling tendencies, titanium again parallels stainless steel.

Generally speaking, titanium is being used to replace both aluminum and stainless steel in certain parts of the airplane structure. When used to replace stainless steel, a distinct weight advantage accrues. The maximum safe operating temperature of the new metal varies from 600 to 800 degrees F., dependent upon the aggregate stresses imposed on the part in which the temperature occurs.

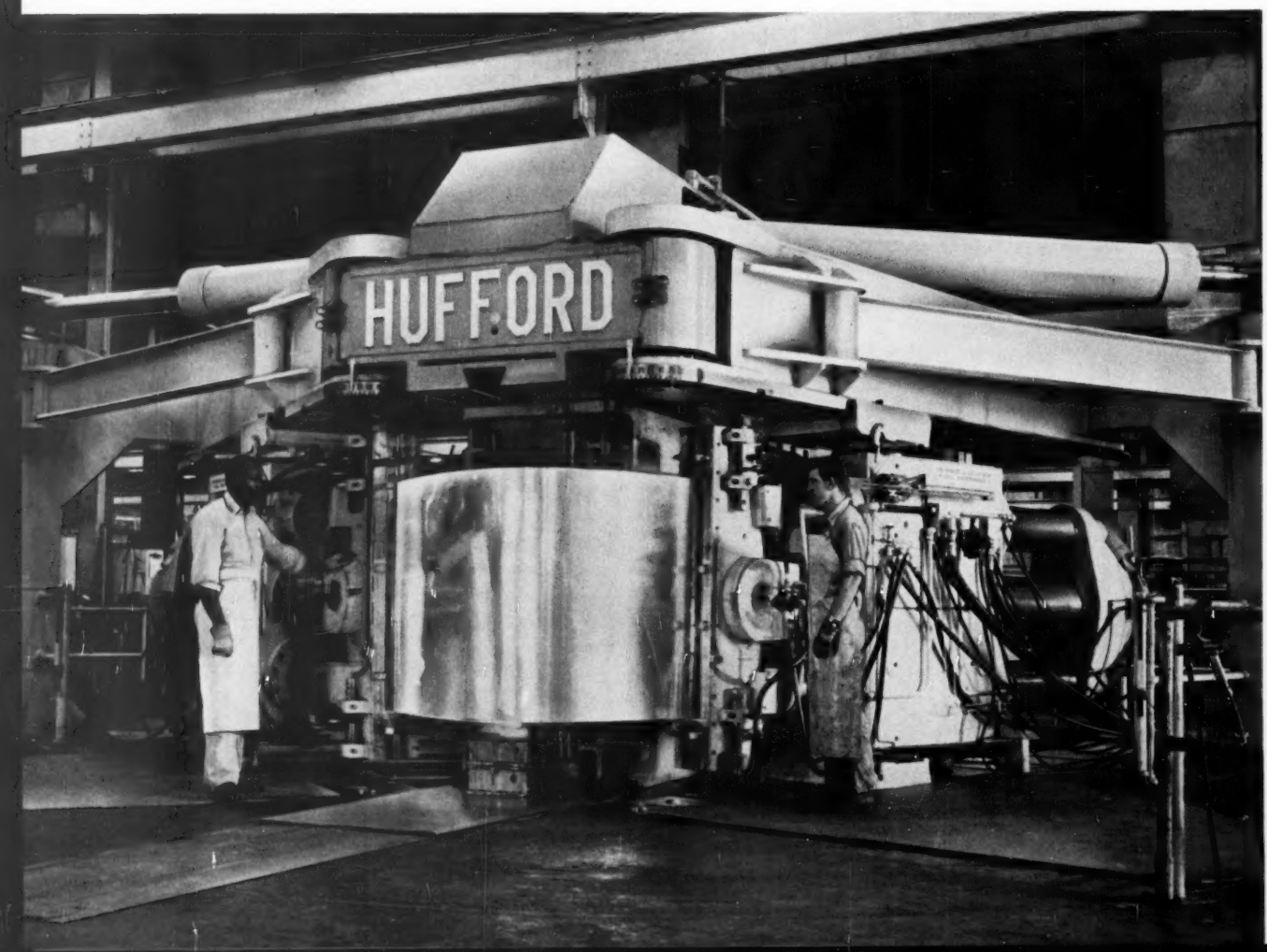
In conclusion, it must be pointed out that many of the fabricating processes being employed with titanium are being used because there has not been sufficient time to develop and perfect better methods. However, research and practical experiences will gradually eliminate the difficulties.

Giant Douglas Planes Built with Huge Machines

By CHARLES O. HERB
Editor

THREE-STORY cargo planes with an overall fuselage length of 130 feet and a height of 48 feet 3 inches from the tip of the rudder to the ground are built on a production basis at the Long Beach, Calif., plant of the Douglas Aircraft Co., Inc. The wing span of these giant Globemasters is 174 feet 1 inch and the maximum height of the fuselage is 20 feet 11 inches. The seagoing ships of Columbus' fleet would pale into insignificance were their size compared with these "ships" of the air.

Huge machines are needed to produce many of the parts necessary for the fabrication of these planes—machines of types and sizes that



Douglas Globemaster

did not exist ten years ago. A typical machine in this category is the 200-ton Hufford stretch-wrap forming machine shown in the heading illustration and in Fig. 1. This machine will take metal sheets up to 6 by 30 feet.

A fairing for a radar dome is shown in Fig. 1 being produced from 0.032-inch thick 24S-O Alclad aluminum alloy. The sheet, 16 inches wide, is completely flat at the beginning of the operation. A groove approximately 2 1/2 inches deep by 4 inches wide is formed in the middle of this sheet. Excess stock is later trimmed from each side of the grooved portion, leaving the final work-piece 6 inches in width.

It will be noticed that a second shallow groove is drawn into the metal above the main groove. This second groove is called a "locking bead" and it prevents the formation of a wrinkle which might flow into the main groove and result in a defective part. The locking bead is trimmed off with the scrap.

This stretch-wrap forming operation is performed with the material in a soft condition. The stretched and formed sheet is heat-treated afterward to an S-T condition. Then a stretch-wrap forming operation is carried out on the same machine to eliminate spring-back and remove any small wrinkles that may have developed during the heat-treatment.

Another Hufford stretch-wrap forming machine of 150 tons capacity in the same shop takes sheets up to 62 inches wide by 144 inches in length. This machine is equipped with sets of sheet-gripping jaws that are individually actuated through hydraulic lines. The advantage derived from using these jaws is that by holding sheet edges to a pattern, a multiple curve can be imparted to the work without wrinkles. There are eleven of these individual jaws on each side of the machine. The form-blocks used in the various stretch-wrap forming machines in this plant are generally made of plastic or Kirksite.

A small Hufford stretch-wrap forming press, provided with special equipment for forming a joggle in extrusions or rolled stock simultaneously with stretch-forming, is illustrated in Figs. 2 and 3. The joggle unit is suspended from the beam of a crane that can be transported to various machines in the plant, the crane being mounted on a steel plate which can be securely fastened by means of bolts to the floor in locations adjacent to the different machines with which the equipment is used.

The joggle head is equipped with a horizontal hydraulically operated ram, Fig. 3. At the front end, a block of required contour is attached to form the joggle. This occurs when the ram goes forward so that a form-block on the front end can exert pressure against the work and the main form-block on the table of the machine. Opposite the point where the ram form-block contacts the work there is, of course, a converse contour on the main form-block. The ram exerts a force of approximately 1 ton.

The joggle head is suspended, as seen in Fig. 2, from a second hydraulic cylinder attached

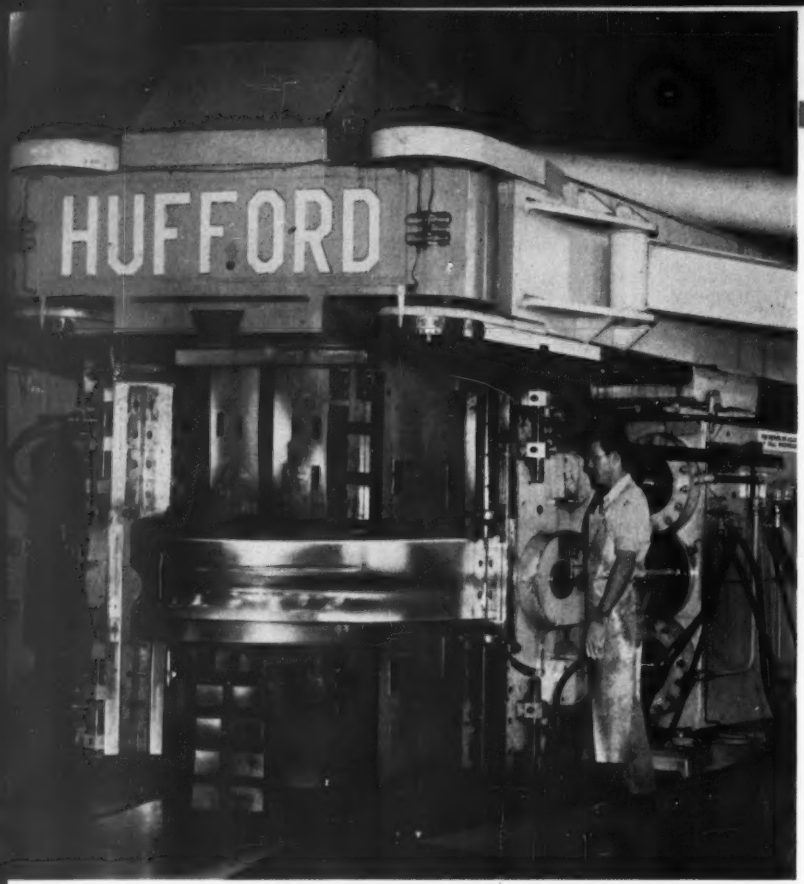
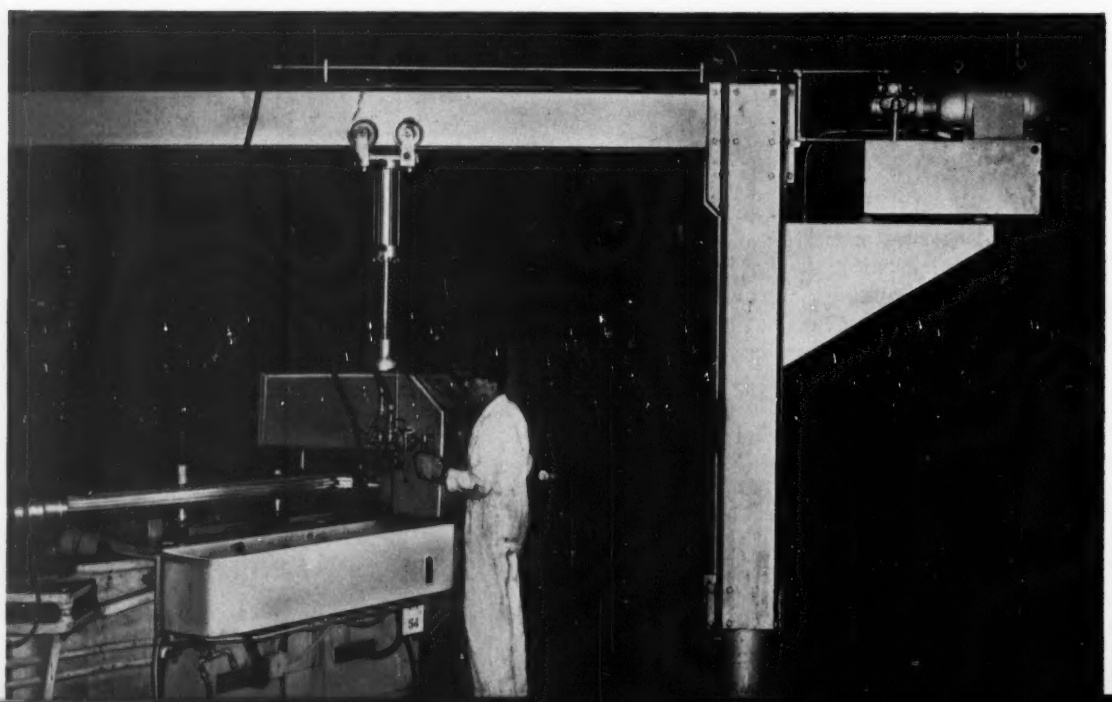


Fig. 1. (Left) Hufford stretch-wrap forming machine used for producing a fairing for the radar domes, it being necessary to produce a groove 2 1/2 inches deep by 4 inches wide

Fig. 2. (Below) Smaller stretch-wrap forming machine equipped with a special unit that produces joggles in extruded or rolled stock

to a trolley that runs on the crane boom. By means of this cylinder the height of the joggle head in relation to the work can be easily adjusted to suit the job. The Vickers hydraulic equipment, which supplies pressure to both cylinders, is mounted on a shelf on the right-hand side of the crane column as shown in this illustration. The crane boom consists of a 12-inch I-beam 10 feet in length.

Chambersburg Cecostamps are used extensively for forming a variety of work from stainless steel and aluminum alloys. In Fig. 4, there is a machine of this type with a minimum die area of 68 by 42 1/2 inches. It is equipped with a die set for producing an inside heater shield from 61S-O aluminum alloy 0.040 inch thick. The blank sheet is approximately 62 inches long by 36 inches wide, and is formed



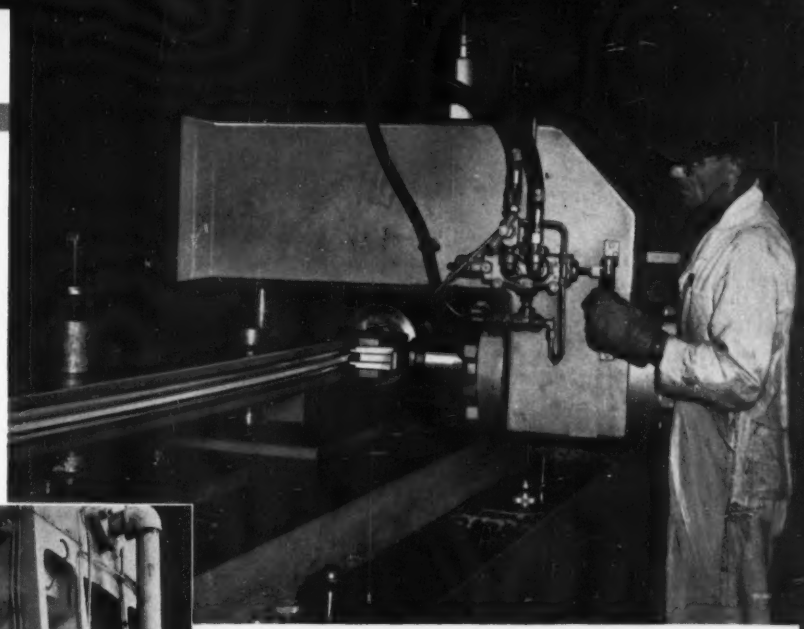


Fig. 3. (Right) Close-up view of the joggling equipment, showing the manner in which the joggle block is pushed hydraulically against the extruded or rolled section

Fig. 4 (Left) Large Cecostamp equipped with a lead punch and Kirksite die for producing a deeply formed inside heater shield from aluminum alloy

Fig. 5. In forming the inner skin here shown, rubber sheets 1 inch thick to a total thickness of 9 inches are placed on top of the blank sheet and then removed, one at a time, after each successive blow

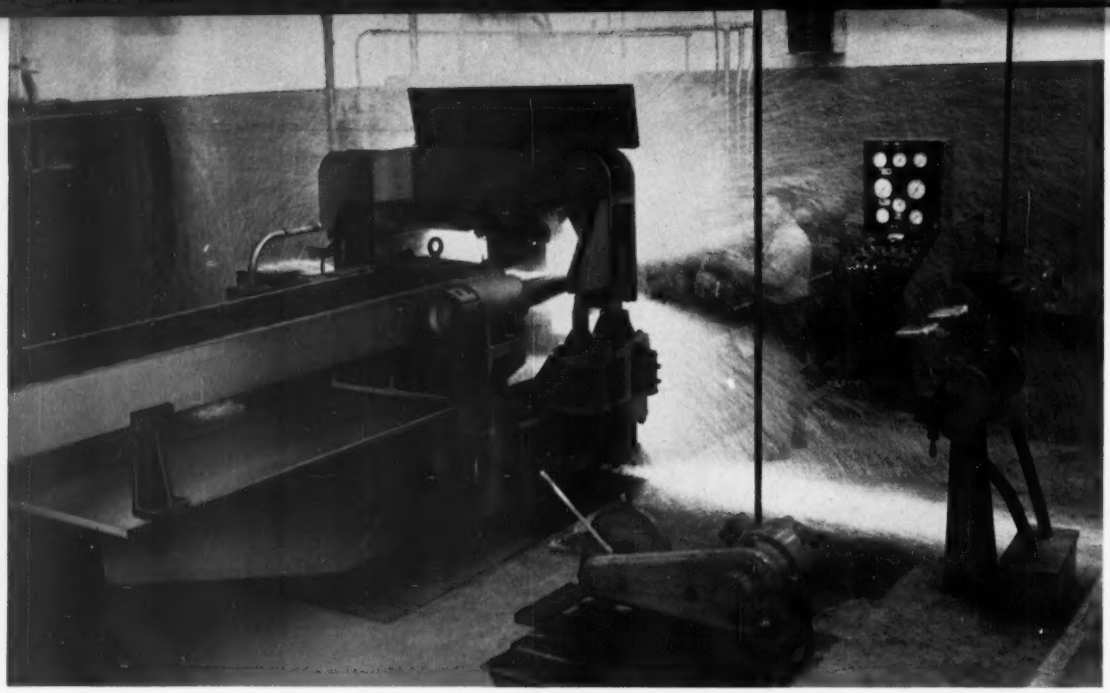


Fig. 6. Huge flash-welding machine employed in the joining of tubes, bars, and structural shapes in fabricating landing-gear cylinders, struts, and other parts

to a maximum depth of 6 inches. Rubber sheets 1 inch thick are laid to a total thickness of 7 or 8 inches on the flat sheet at the beginning of an operation and removed, one at a time, after successive blows until the part has been brought to the desired contour. Eleven or twelve blows are struck, one or two blows per rubber sheet.

After the part is removed from the machine, it is heat-treated and then returned to the Cecostamp for a restriking operation in which two or three blows are directed on the part. In the restriking operation, a sheet of sponge rubber 1/4 inch thick is placed on top of the work-piece. Following the restriking operation, the piece is trimmed to the required outline.

The Cecostamp shown in Fig. 5 is equipped with a die set for producing an inner skin from 61S-O aluminum alloy 0.040 inch thick. The blank is about 4 feet long by 2 feet wide, and it is formed to a maximum depth of 6 inches. In this operation, nine pads of 1-inch thick rubber are placed on the blank sheet at the beginning of the operation and eleven or twelve blows are struck. This part is also returned to the Cecostamp after heat-treatment for a restriking operation that brings it accurately to specified dimensions. The lead punch seen on the machine weighs 10,600 pounds and the Kirksite die, 8000 pounds.

What is believed to be the largest flash welder on the Pacific Coast is illustrated in Fig. 6. This Taylor-Winfield machine is employed for a variety of operations on landing-gear parts and struts, and will weld steel, titanium, and other metals. Bars, tubes, and structural shapes with

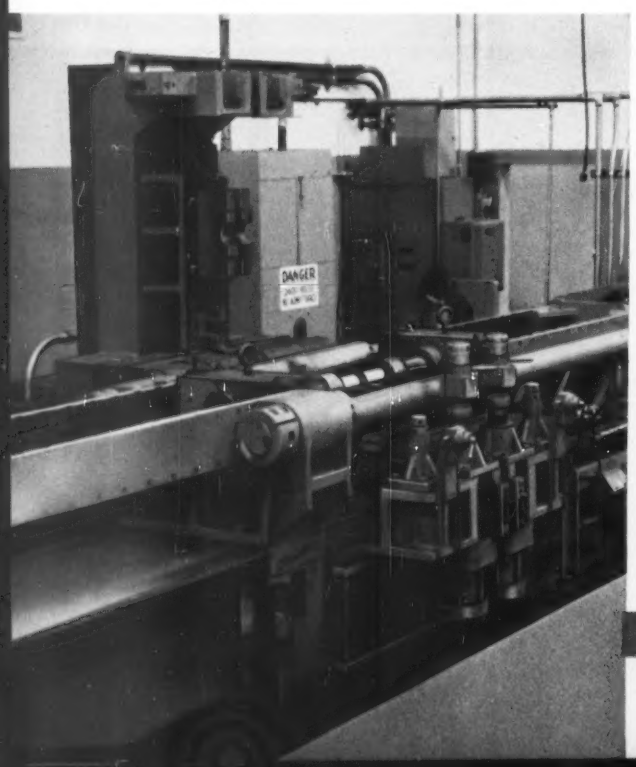


Fig. 7. Close-up view of a large flash-welding machine showing the swinging arms that carry the combination clamps and upper electrodes, in the raised position

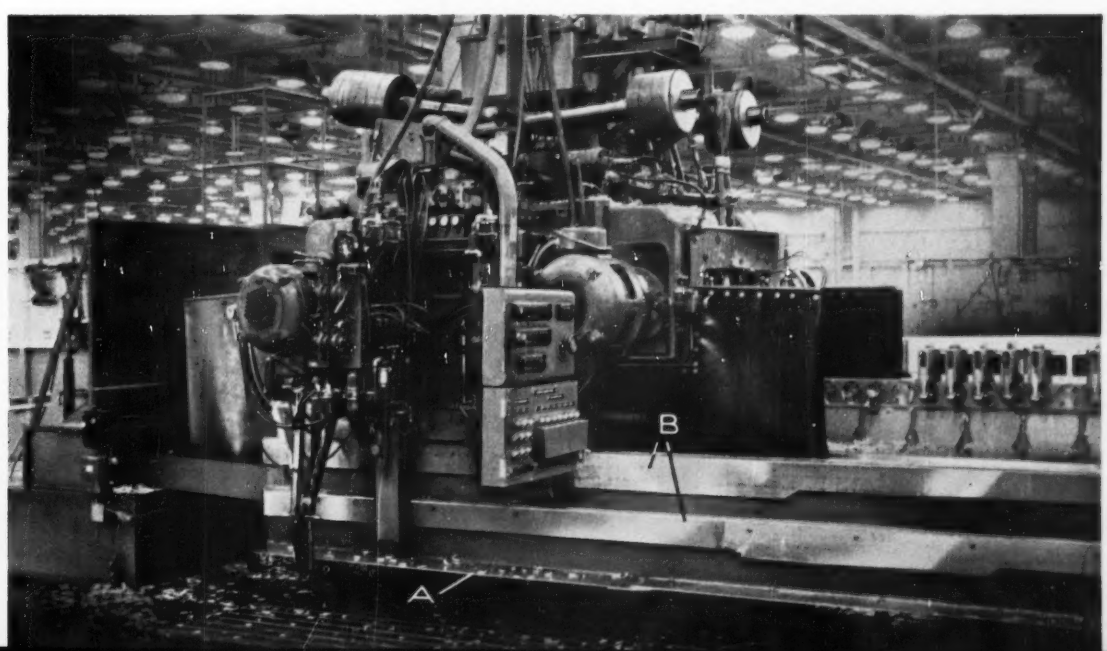
Fig. 8. Another close-up view of the machine showing the hinged arms in the lowered or working position

a contact area up to 12 square inches can be joined practically instantaneously. The machine has a rating of 800 kilovolt-amperes, and a maximum welding current of 110,000 amperes can be provided. Work up to 12 feet in length can be handled.

When the tubes or bars to be welded together are loaded into the machine, the hinged arms to which the combination clamping jaws and upper electrodes are attached are in the raised position seen in Fig. 7. These arms are lowered into the clamping position shown in Fig. 8 through the action of an air cylinder operated by means of a lever, as indicated. A clamping force of 40 tons holds the work-pieces while they are being heated, after which the platen that holds one of the work-pieces is moved toward the stationary piece to effect the welding operation. The maximum force applied in welding is 12 tons. The amount of upset varies with the dimensions of the work.

Spar-milling is one of the most important operations in the plant, and is performed on machines capable of handling spars 60 feet in length. In spar-milling operations, it is necessary to actuate the milling head sideways and vertically in order to machine the webs and flanges of the spars to the various contours as the table carries the spar past the cutters. Sidewise movements are effected by means of a horizontal template fastened to the side of the bed, as shown at *A* in Fig. 9, while vertical movements are obtained from vertically mounted templates such as seen at *B*. Hydraulically actuated clamps seen at the right-hand side of the illustration, hold down the spar securely on the table for the milling operation.

Fig. 9. The milling head of a large Farnham spar-milling machine, together with the templates at the side of the bed which effect vertical and horizontal movements of the milling head



Ultrasonic Inspection Insures Dependable Jet-Engine Parts

Observation of the transmission and reflection of high-frequency sound waves is a method widely employed at Allison to determine internal defects in jet-engine parts. Details of this important method of non-destructive testing are described in this article

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Lockheed F-94C Starfire

THE production of dependable aircraft jet engines demands the manufacture of high-quality, structurally sound parts. Since most of the defects that might cause failure of a part during service are hidden beneath the surface, the only practical method of finding them is by some means of non-destructive testing. In addition to the all-important safety factor, the early use of non-destructive testing eliminates the additional cost of subsequent machining on defective parts.

When the Allison Division of the General Motors Corporation first began to produce jet engines, the turbine wheels of these engines were inspected by means of radiographs obtained from a 1,000,000-volt X-ray unit. Although radiographic examination of the forgings did reveal the presence of large defects, it was felt that it lacked the sensitivity to detect small defects and certain structural inhomogeneities. On the basis of tests conducted by the General Motors Research Laboratories, it was found that small defects could be found with a high degree of accuracy by means of ultrasonic testing. Since that time, this method has been adapted to the regular production inspection of many jet-engine parts.

Ultrasonic waves, or vibrations, are sound waves of a frequency beyond the hearing range of the human ear—approximately 20,000 cycles or more per second. Such ultrasonic vibrations tend to travel in a straight line and are reflected by mechanical discontinuities occurring in the medium through which they are traveling.

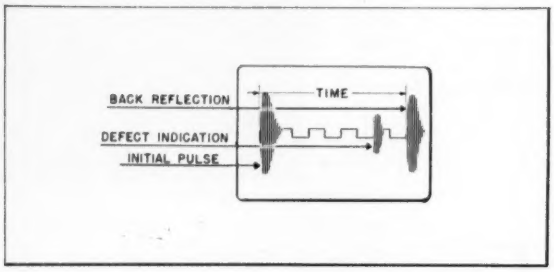
At Allison, ultrasonic inspection is accomplished by means of Reflectoscope test instruments, such as the one shown in Fig. 1, made by Sperry Products, Inc., Danbury, Conn. These instruments electronically generate ultrasonic vibrations ranging from 1/2 to 10 megacycles (1 megacycle equals 1,000,000 cycles), and send them in a pulsating beam through the part to be tested. Any discontinuity, as well as the opposite end of the part being tested, will reflect the vibrations back to the instrument. The instrument measures the elapsed time between the initial pulse and the return of all reflections, and indicates such time lapse on a cathode-ray tube indicator, as shown diagrammatically in Fig. 2.

Ultrasonic inspection is performed by moving a searching unit along the test surface (called scanning), and observing the indications on the cathode-ray tube. The searching unit receives short, repetitive, high-frequency electrical pulses from the pulse generator and amplifier through a coaxial cable, and transforms them, by means of natural quartz crystal, into mechanical vibrations of ultrasonic frequency. These vibrations are transmitted into the part being tested. Reflected vibrations, or echoes, of the pulse from a defect or from the opposite side of the part under test are converted back into electrical energy by the crystal, amplified to strengthen the signal, and presented on the screen of the cathode-ray tube as vertical indications of "pips."

The initial pulse indication, which is the first pip seen on the left side of the viewing screen (shown diagrammatically at the top in Fig. 3), is caused by reflections from within the searching unit and the test surface. The reflection from the opposite side of the part under test is indicated by the pips on the right side of the screen. Any defects between these two surfaces will be

Fig. 1. (Left) Ultrasonic inspection instrument that electronically generates vibrations ranging from 1/2 to 5 megacycles to find internal defects

Fig. 2. (Below) Diagrammatic representation of the indications seen on the viewing screen of the cathode-ray tube of a Reflectoscope



indicated by pips between the initial pulse and back reflection—their location depending upon the depth of the defects in the part.

The square wave marker scale (sometimes erroneously called "inch-marks") shown across the center of the cathode-ray tube viewing screen is used to measure distance units between reflection indications. These markers are superimposed on the horizontal sweep line of the cathode-ray tube by means of a separate circuit. This scale can be adjusted to show feet or inches, or any other unit of length desired, thus providing the operator with a means of determining the linear location of a defect.

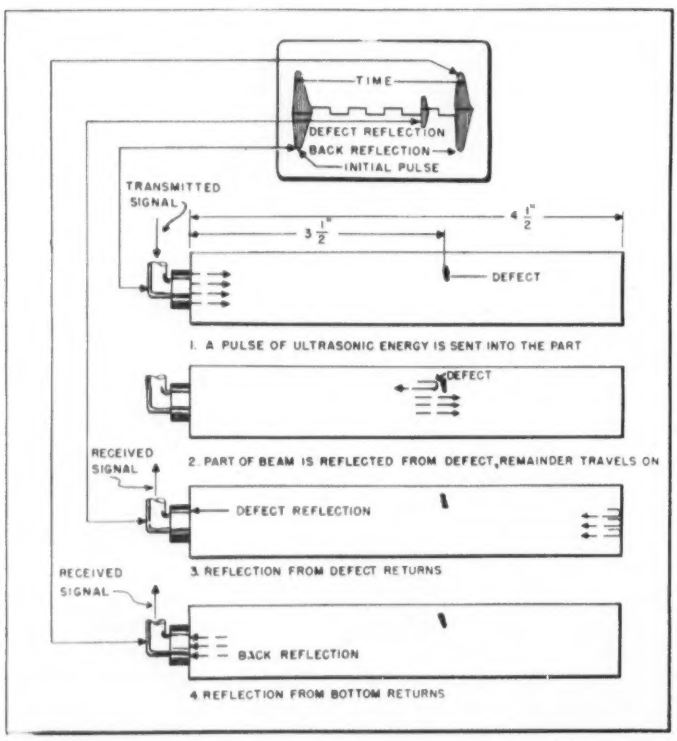


Fig. 3. Defect located 3 1/2 inches from one end of a 4 1/2-inch long shaft is indicated by pip between the initial pulse and back reflections

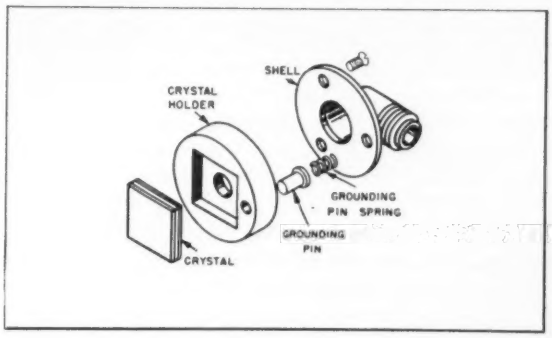


Fig. 4. (Left) Exploded view showing construction of a typical straight beam searching unit. Spring-loaded grounding pin rides on test surface

Fig. 5. (Below) Searching units are available in a variety of sizes and frequencies to suit the mechanical properties of material being tested

The pattern obtained on the Reflectoscope viewing screen can be expanded (called a "delayed sweep") so that any portion of the total distance being tested can be presented on the viewing screen. For example, in testing a 10-foot long shaft, the Reflectoscope can be adjusted so that the length from the fifth foot to the sixth along the shaft can be presented across the entire width of the viewing screen. In such cases, the initial pulse and the back reflection would be off the screen.

The crystal-containing, hand-held searching unit of the Reflectoscope is used as a transducer to convert electrical pulses into mechanical vibrations, to introduce such vibrations into the part being tested, and to receive the mechanical vibrations or echoes from the part and convert them into electrical signals for display on the viewing screen. The piezoelectric quartz crystals used in the searching units vibrate at a fixed frequency, depending on the size to which they have been ground.

An exploded view of a typical searching unit is shown in Fig. 4. The metal-plated back of the crystal is soldered to the central wire of the coaxial searching unit cable. The crystal is cemented to the holder. A spring-loaded grounding pin rides on the test surface and provides the necessary electrical connections.

Standard searching units are available in a variety of sizes and frequencies, such as those seen in Fig. 5, to suit specific electrical and mechanical properties. Such units can be provided for both straight beam testing and angle beam testing, Figs. 3 and 6, respectively. In the latter, the searching crystal is positioned at an angle to the test surface and the rays of the ultrasonic waves enter the material (through a plastic wedge) in a direction angular to the test surface. Special searching units with recessed work faces are furnished with flat plastic contact shoes that can be ground to any desired curvature for testing non-planar surfaces.

Ultrasonic testing can be used to inspect any material capable of transmitting ultrasonic vibrations, and is particularly successful in testing metals that are reasonably homogeneous and small-grained. Some of the materials that have been successfully tested with the Reflectoscope are steel, malleable cast iron, aluminum, magnesium, copper, nickel, and Monel metal. The types

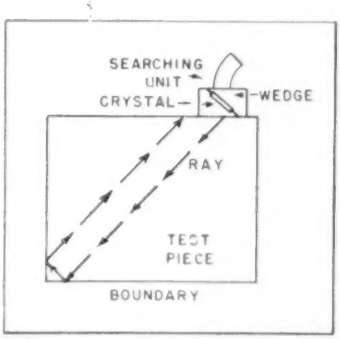


Fig. 6. In angle beam testing, the crystal is set at an angle to the test surface and the ultrasonic waves enter the material at an angle

of discontinuities normally detected by the Reflectoscope include blow-holes, bursts, flakes (internal fissures), impurity inclusions, seams, segregations, laps, laminations, and porosity.

The ability of the Reflectoscope to find a defect will vary with the distance of the defect below the test surface. The size of the defect that can be detected is also dependent upon the grain size of the material. With respect to their depth below the test surface, the Reflectoscope will locate defects within approximately 2 per cent of their actual location.

The set-up employed at Allison for ultrasonic inspection of jet-engine turbine wheels is shown in Fig. 7. The heat-resistant, stainless-steel forging is received for inspection in a rough-turned condition, with the faces parallel and machined to a surface finish of not more than 250 micro-inches r.m.s. A 2 1/4-megacycle crystal is used to search all flat surfaces of the turbine wheel forging, and a 1-inch round, 2 1/4-megacycle crystal for testing 180 degrees of the periphery. A camera, seen mounted in front of the viewing screen, can be used to photograph indications.

To transduce the sound wave into the part being tested, S A E 10 oil is used as the couplant, and is brushed on the surfaces to be tested. The oil fills up surface irregularities and serves to eliminate any air pockets which might exist between the test surface and the face of the crystal and interfere with transmission of the sound waves into the forging or result in false indications on the viewing screen.

To familiarize the operator with the inspection of this specific part, and for checking the calibration of the instrument, a master test block made from a scrap turbine wheel forging is employed, Fig. 8. This block contains drilled holes to simulate defects of known size and areas having known losses of reflection. Any defects found in a production turbine wheel are compared to those in the master.

A careful analysis is necessary to determine the proper frequency to be employed for ultrasonic testing of a specific part. The higher the frequency, the greater the sensitivity in detecting small defects. However, lower frequencies will provide the power necessary for the deepest penetration into the part being tested. Complete penetration is desirable when testing bar stock, shafts, or similar long objects from one end only. In extreme cases, such as attempting to detect very small defects in long parts, some compromise must be made to achieve adequate penetration along with the desired sensitivity.

The more uniform the size and alignment of the grain structure in the part being tested, the greater the possibility of obtaining maximum depth of penetration. Also, the smaller the grains, the deeper the penetration that can be obtained. Since working of the material or heat-treatment generally reduces the grain size and aligns the grains uniformly, material in such condition will permit greater penetration. Smoother finish of the test surface will also permit better contact and sound transmission.

Turbine wheel shafts, approximately 3 inches in diameter and 2 feet long, are flash-welded to

Fig. 7. Set-up for ultrasonic inspection of forged stainless-steel, jet-engine turbine wheels. Crystals of 2 1/4 megacycles are employed

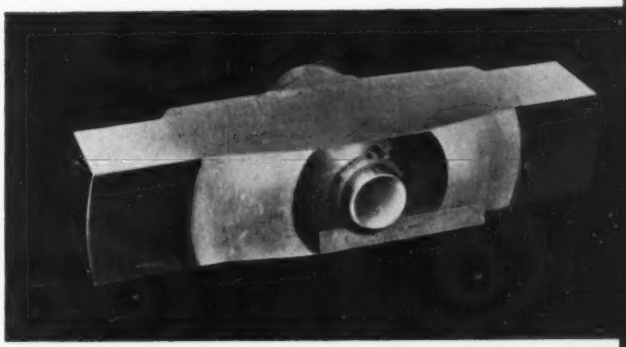


Fig. 8. Master test block, made from a scrap turbine wheel forging that is drilled to simulate defects, is used to calibrate Reflectoscope

the turbine wheels for the J-33 jet engines. Prior to welding, the entire length of the ground shaft is inspected with the Reflectoscope set-up shown in Fig. 9. The inspection is performed at 120-degree intervals around the periphery of the shaft, employing a 1-inch round, concave, 2 1/4-megacycle crystal. The plastic contact shoe of the searching unit is ground to the required curvature for testing the 3-inch diameter shaft.

Compressor rotor impellers for the J-33 jet engine are made from aluminum-alloy finger forgings which are rough profiled and faced on both hub surfaces prior to ultrasonic inspection. An immersion type of ultrasonic testing unit is now being built for Allison by Sperry Products that will permit accurate and automatic inspection of the smoothly contoured rotor hubs.

Ultrasonic inspection of the hub surfaces on the impeller is shown in the heading illustration. A 1-inch round, 2 1/4-megacycle crystal is used in this test. Even with the ultrasonic inspection limited to these areas, material quality has been controlled to the point that spin test and engine operation failures have been practically eliminated. One example of the type of defect found in impeller forgings is illustrated in Fig. 10. By carefully noting the location of the defective area shown in ultrasonic inspection, and fracturing the impeller through this area, the defect was easily revealed.

A most important requirement for successful ultrasonic testing is proper training of the inspector in interpreting indications. A typical reflectogram (photograph of a pattern appearing on the viewing screen of a Reflectoscope) is shown in Fig. 11. As previously mentioned, the first indication seen on the extreme left side of the screen is known as the initial pulse indication. Too long or wide an initial pulse indication may obscure or hide indications from defects lying close to the test surface, and should be adjusted to be as short and narrow as possible.

To the right of the initial pulse (and seen in the center of Fig. 11) is a direct reflection from a defect in the part under test. To the right of the defect pulse is the first back reflection indication, caused by the return of the portion of the ultrasonic vibrations that has passed completely through the part being tested and been reflected from the opposite side of the part. Indications to the right of the first back reflection are generally useful only for noting the depth of penetration.

The amplitude of the defect pulse is a function

Fig. 9. Jet-engine turbine wheel shafts are inspected over entire length and at 120-degree intervals around the periphery

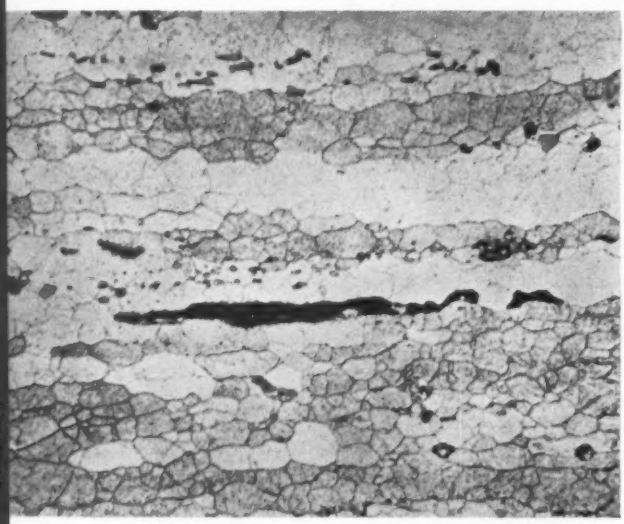


Fig. 10. Photomicrograph of defect found in a fractured jet-engine impeller forging, which was located by ultrasonic inspection

of the surface area of the defect in a plane perpendicular to the path of the sound waves. A defect that does not lie parallel to the test surface will cause a loss of reflection as shown by a reduction in the amplitude of the first reflection pulse. A large discontinuity lying at an acute angle to the searching unit crystal face can be identified by a shifting of the indication as the searching unit is slid along the test surface.

Care must be exercised in differentiating between a defect reflection and one caused by a flange or some other structural detail on the part being inspected. If the path of reflection from a flange is shorter than the paths from the opposite side of the part, it will result in an indication to the left of the back reflection on the viewing screen. In inspecting a number of similar parts, the operator can easily identify such structural reflections.

Reduction, fading, or loss of the back reflection may be due to any one of several causes. The ultrasonic vibrations may be blocked off by a discontinuity large enough to reflect the entire beam. Also, a large defect positioned at an angle to the test surface may reflect the entire beam in a direction which will prevent its return to the searching unit. Fading or loss of back reflection can also be caused by porous areas that disperse or scatter the beam, large grain size, insufficient penetration, a poor surface condition that might prevent all the energy from entering the part, or the use of insufficient couplant fluid.

Ultrasonic vibrations from the searching unit

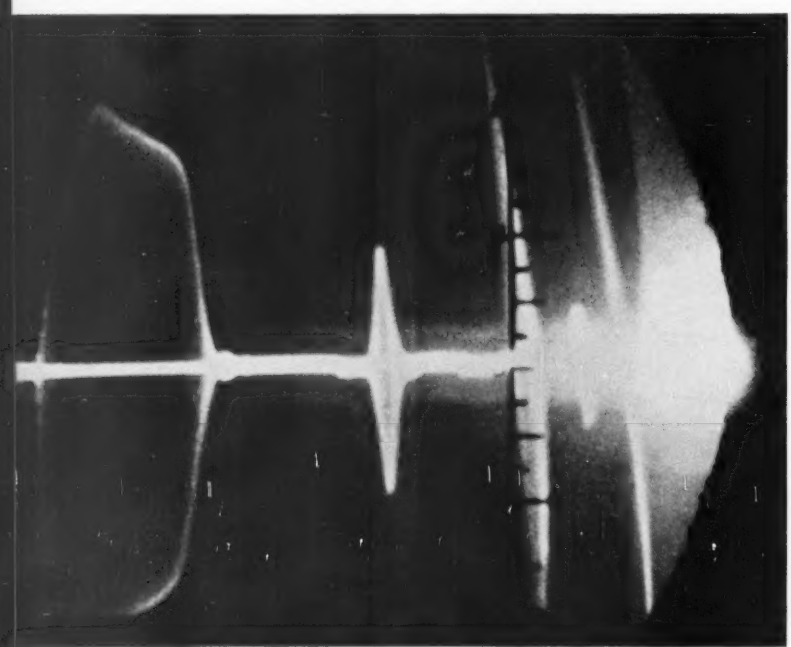
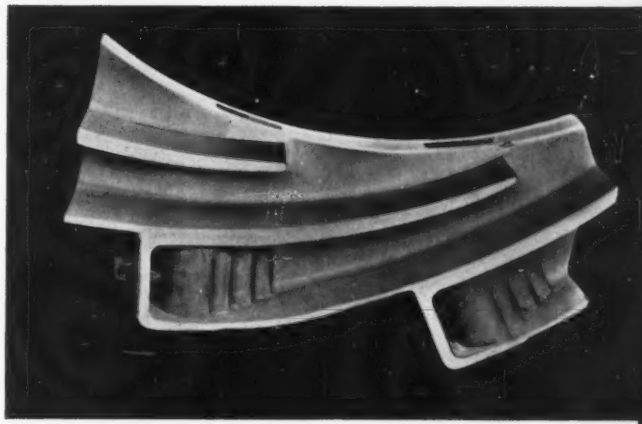


Fig. 11. Photograph of a pattern appearing on the viewing screen of a Reflectoscope. Initial pulse indication is seen on left-hand side of screen

Fig. 12. Cross-section of a cast magnesium-alloy diffuser, showing the range of wall thicknesses that are measured with a Sonigage



of the Reflectoscope take the form of a conical beam with its axis normal to the center of the searching unit crystal. The higher the frequency, the narrower the beam for a given size searching unit; also, the larger the searching unit, the smaller the angle of beam spread at any given frequency. With a high frequency and a large crystal, the beam spread is negligible.

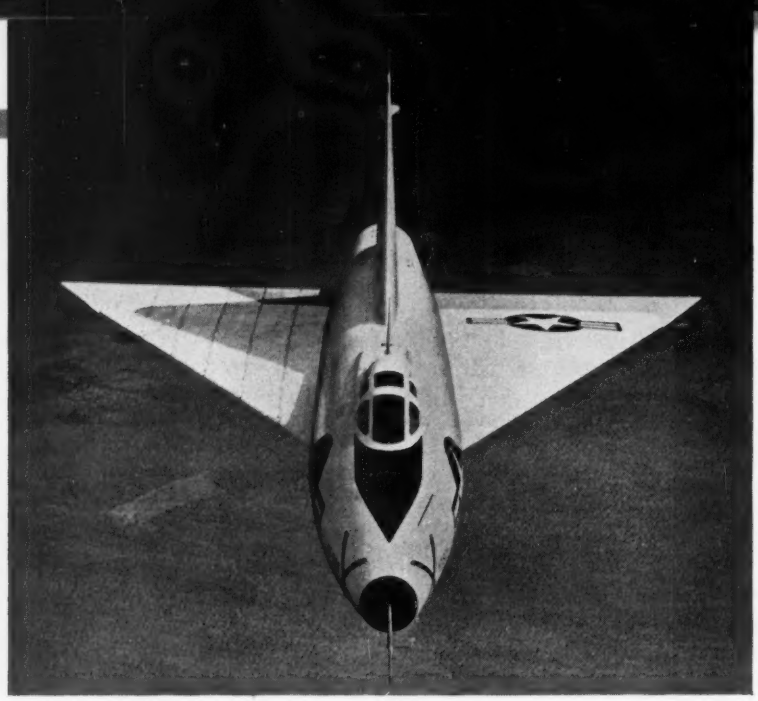
Another application of ultrasonic inspection at Allison makes use of the Sonigage, Fig. 13, (developed by the General Motors Research Laboratories) for determining the wall thickness of parts whose shape prevents the use of conventional measuring instruments. The construction of the Sonigage is similar to the Sperry Reflectoscope except that the unit operates on the resonant frequency principle—generating a continuous range of sound wave frequencies from 1 to 5 megacycles, instead of one frequency as does the Reflectoscope.

In the Sonigage, the mechanical waves of continually varying frequency are also transmitted through the material being tested by a quartz crystal. A sharp increase in the amplitude of the mechanical vibrations occurs at the resonant frequency of the material, and is indicated by a peak on the viewing screen of the cathode-ray tube. By measuring the distance between these resonant peaks and observing the number of peaks on the screen, the frequency and therefore the thickness of the part can be determined.

The application shown in Fig. 13 is for determining the wall thickness of J-33 jet-engine diffusers. Since the shape of these magnesium-alloy castings prevented the use of conventional measuring means, this inspection was devised in order to find castings whose wall thicknesses were below blueprint requirements. A 1-inch round 2 1/4-megacycle crystal is used to check the outer surfaces of the critical areas on these castings.

Wall thicknesses can be determined within 0.005 inch by this method of ultrasonic inspection. Blocks of the same material in graduated thicknesses are used as master set blocks to calibrate the Sonigage instrument. The range of wall thicknesses measured is indicated by the cross-section of the diffuser shown in Fig. 12.

Fig. 13. Various wall thicknesses in the complex jet-engine diffuser casting are determined by means of a Sonigage



Convair XF-92A
Delta-Wing Interceptor

Convair Tools up to Produce World's First Delta-Wing Airplane

By A. P. HIGGINS
Works Manager, Plant 2
Consolidated Vultee Aircraft Corporation
San Diego, Calif.

THE Convair XF-92A, here seen in flight, is the world's first delta-wing airplane. This revolutionary, high-speed airplane formed the basis for development of the Air Force F-102 delta-wing interceptor now going into production at Convair's San Diego Division. Flight tests to date indicate that the triangular-shaped wing, with a sweep of 60 degrees, offers less drag with better maneuverability and stability at high speeds. Directional control for the plane is provided by a triangular vertical fin, and "elevons" on the wing trailing edge replace conventional ailerons and elevators.

Plant 2 at Convair is being tooled up with the most modern machine tools available for the production of the F-102 delta-wing interceptor and other Air Force projects. One such machine—a Projecto-Form grinding machine manufactured by the Cincinnati Milling Machine Co. and seen in Fig. 1—facilitates toolmaking and form grinding. Extremely accurate profile shapes on parts such as form tools and templates are being ground accurately and economically on this machine. The grinding operation is controlled by comparing an optically enlarged image of the work with an enlarged scale drawing.

As seen at the left in Fig. 2, concentrated light from a bulb is focussed and directed across the top of the work-piece. A lens projects a magnified image of the work on an optically flat mir-

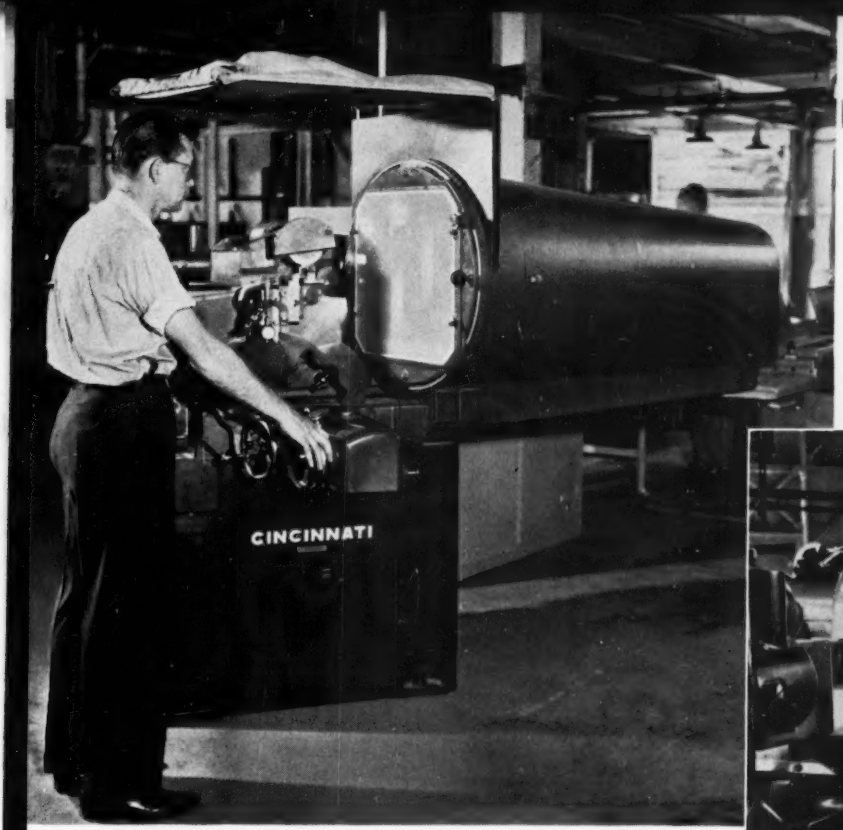


Fig. 1. (Left) Projecto-Form grinding machine permits fast, accurate grinding of profile shapes on form tools and templates by comparing work with drawing.

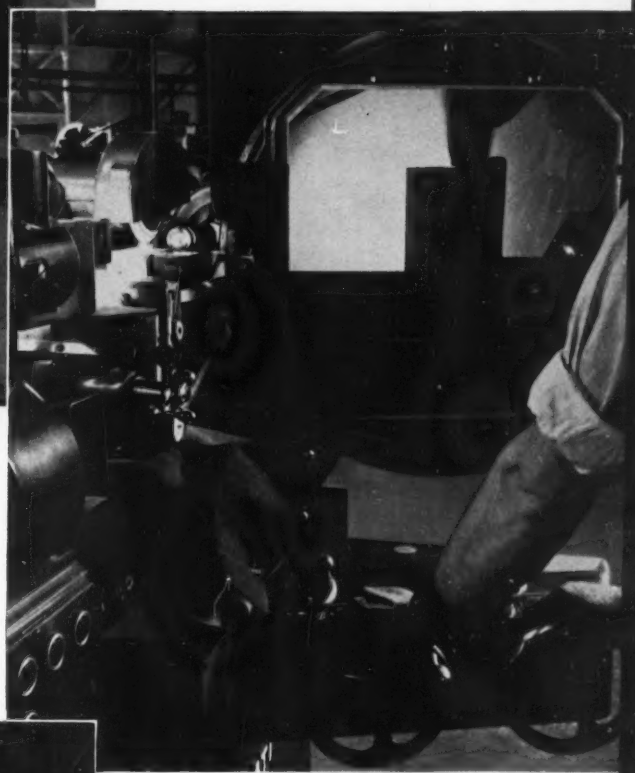


Fig. 2. (Right) Close-up of the optical grinding machine shown in Fig. 1. Image of work is reflected onto a ground-glass viewing screen in front of operator.

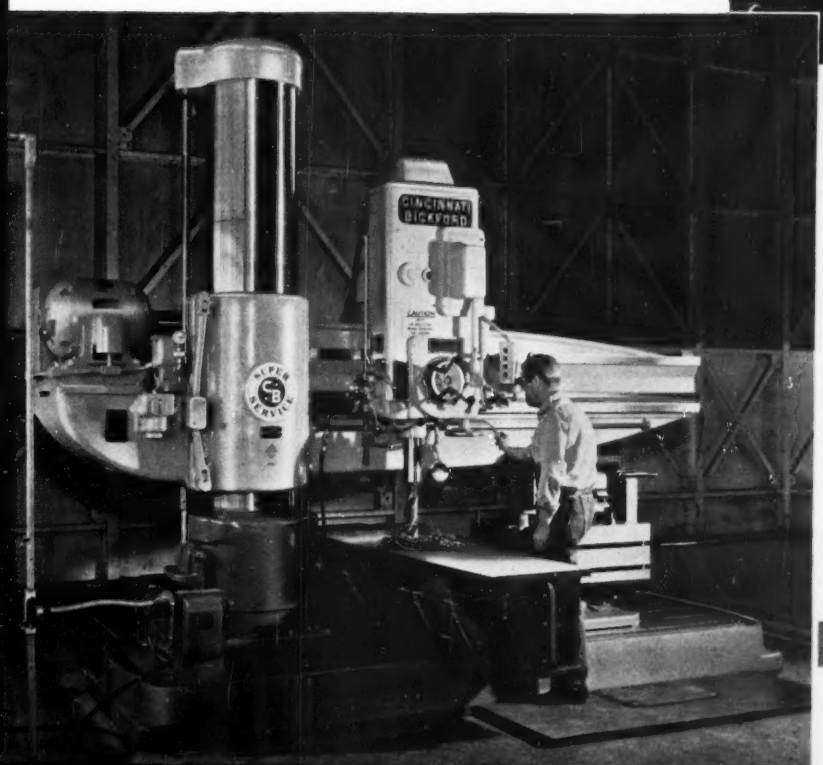


Fig. 3. Radial drill, having 8-foot long arm and column 22 inches in diameter, is being employed to drill and ream large holes in tooling weldment.

Fig. 4. Friction sawing is performed on this machine with the blade traveling at a surface speed of 9000 feet per minute.

ror that reflects an image of the work onto a ground-glass viewing screen directly in front of the operator. The magnification ratio can be changed from 20 to 1 to 40 to 1 by simply replacing the projection lens.

An enlarged outline of the desired work profile, accurately drawn on a coated glass plate to the scale of the magnification, is mounted behind the viewing screen for comparison with the projected image of the work while grinding. The wheel-head can be adjusted both vertically and transversely by means of two handwheel controls for each slide. The larger handwheels provide a coarse feed for setting up, and the smaller are for fine feeds. The wheel-head is reciprocated longitudinally by hydraulic means, and both the length of stroke and rate of reciprocation are adjustable.

Precision drilling and reaming of large holes is performed on the Cincinnati Bickford radial drilling machine shown in Fig. 3. This machine has an 8-foot long arm and a column 22 inches in diameter. All of the controls are conveniently located within easy reach of the operator. The work-piece seen being drilled is a large weldment that will be used as tooling in producing the F-102 delta-wing airplane.

Friction sawing of hard materials is performed at Convair on the DoAll machine seen in Fig. 4. With the saw blade traveling at a surface speed of 9000 feet per minute, enough frictional heat is developed in the cut to soften the material, and the teeth of the blade carry this softened material out of the cut.

Most ferrous materials, such as steel and alloy steels having a low melting point range, lend themselves to friction sawing. The hardness of the material being cut has no apparent effect on the efficiency of friction sawing. In training men to operate the friction sawing machine, hand files were cut up with no difficulty. An angle-iron is shown being sawed in the illustration. A hydraulic feed table can be used to feed heavy sections or harder materials, to prevent fatigue of the operator, and to insure uniform feed rates.

On the special Sundstrand Rigidmil shown in Fig. 5, the work is located between centers in a swiveling fixture mounted on the machine table. An automatic, hydraulic tracer mechanism controls the vertical movement of the helical milling cutter, thus duplicating on the work-piece the contour of a template.

As the table, fixture, and work are fed past the cutter, the work is swiveled about its center axis by a roller in contact with another template, seen mounted on the front of the machine bed. At the end of the cut, a control dog serves to reverse the direction of the table feed, and the milling head returns rapidly to its starting position. The table stops automatically at the end of its rapid return stroke, and the cycle can be repeated. A power unit was designed by Convair and installed on this Rigidmil. This unit permits a speed reduction of 1725 to 1, so that the table can be fed at the required slow rate.

Close dimensional accuracies are held, and fine surface finishes obtained, in cutting contours and splines in heavy work-pieces and weldments on the Rockford 20-inch stroke, hydraulically operated slotter seen in Fig. 6. Speeds of the cutting and return strokes of the ram are infinitely adjustable, and the length of the ram stroke can be easily set by adjusting a hydraulic valve control. The vertical slotting machine is equipped with a rotary table and indexing device, which adds to its useful range of work. The table can be rotated, and fed transversely or longitudinally.

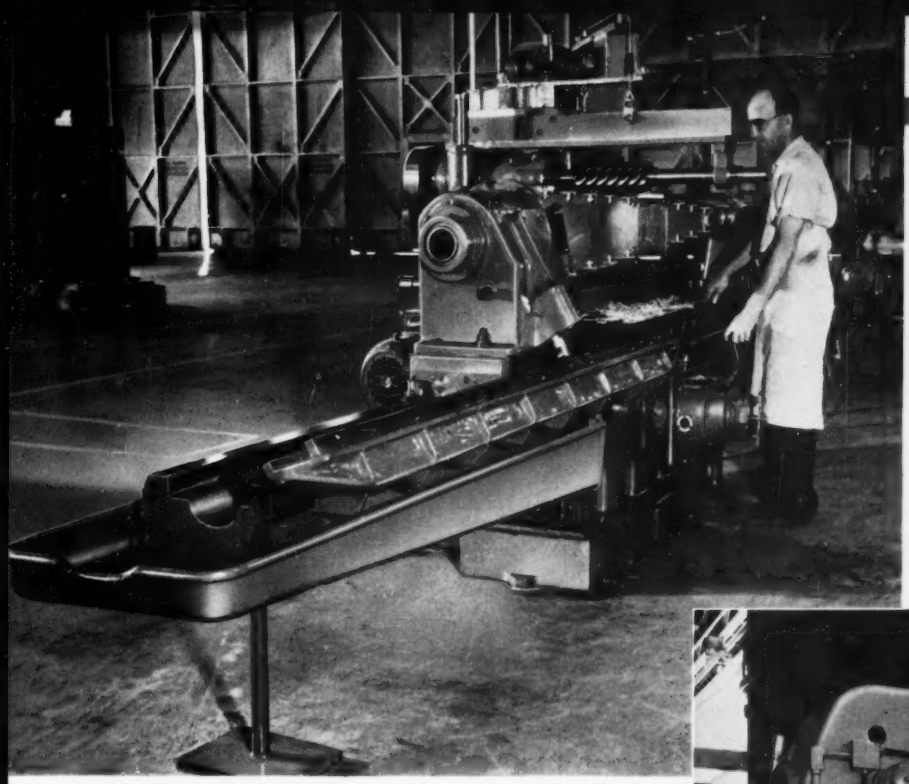
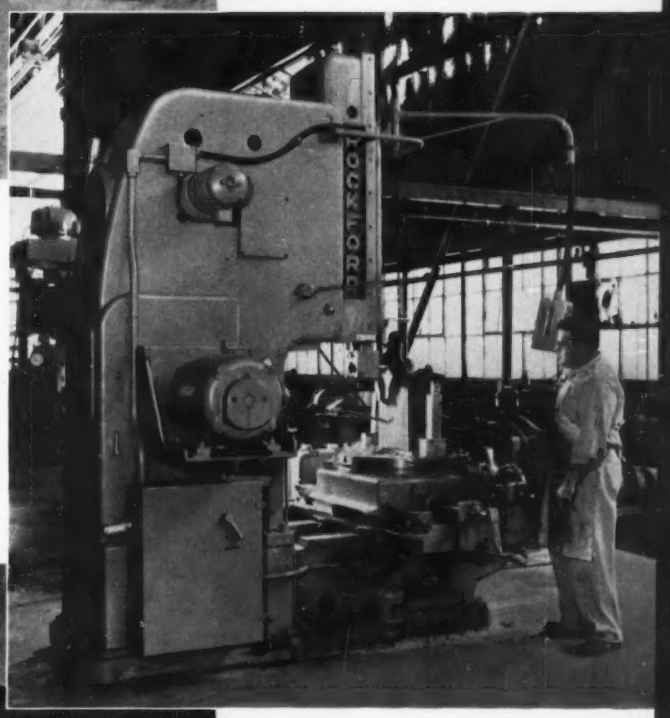


Fig. 5. (Left) Hydraulic tracer mechanism controls vertical movement of helical milling cutter, and work is swiveled by roller in contact with template.

Fig. 6. (Below) Hydraulically operated vertical slotting machine has a 20-inch stroke and rotary, indexing table for cutting contours and splines in heavy parts.



Both long and short work-pieces are machined on the Lodge & Shipley engine lathe shown in Fig. 7. This lathe has a swing over the bed of 34 1/2 inches, and can handle parts up to 12 feet long. To increase its versatility, the lathe is equipped with a taper attachment, direct-reading diameter and length attachments, and a double-nut type, power rapid-traverse attachment that can be quickly engaged and disengaged as required.

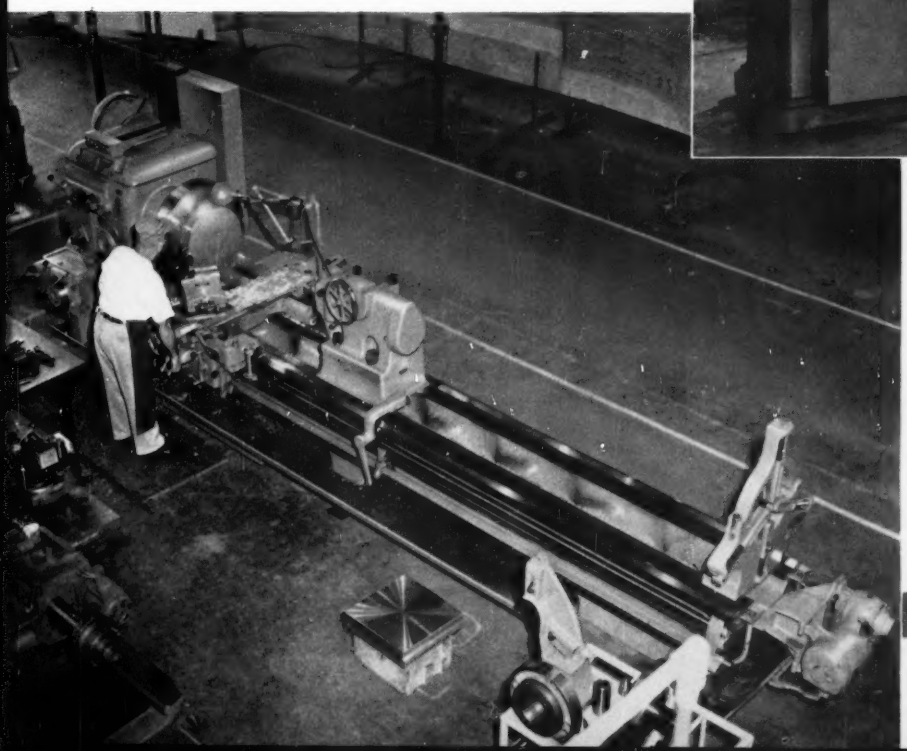
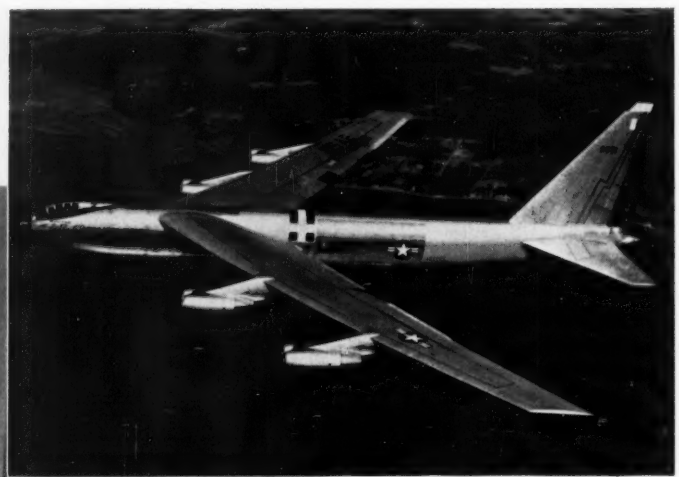


Fig. 7. Large engine lathe having a swing over the bed of 34 1/2 inches can handle parts up to 12 feet long. A die-plate is shown being turned.

Boeing Makes Complex Electrical Circuits without Wires

By JOHN McMASTER
Photo Template Unit Chief
Boeing Airplane Co.
Seattle, Wash.



Boeing YB-52
Stratofortress

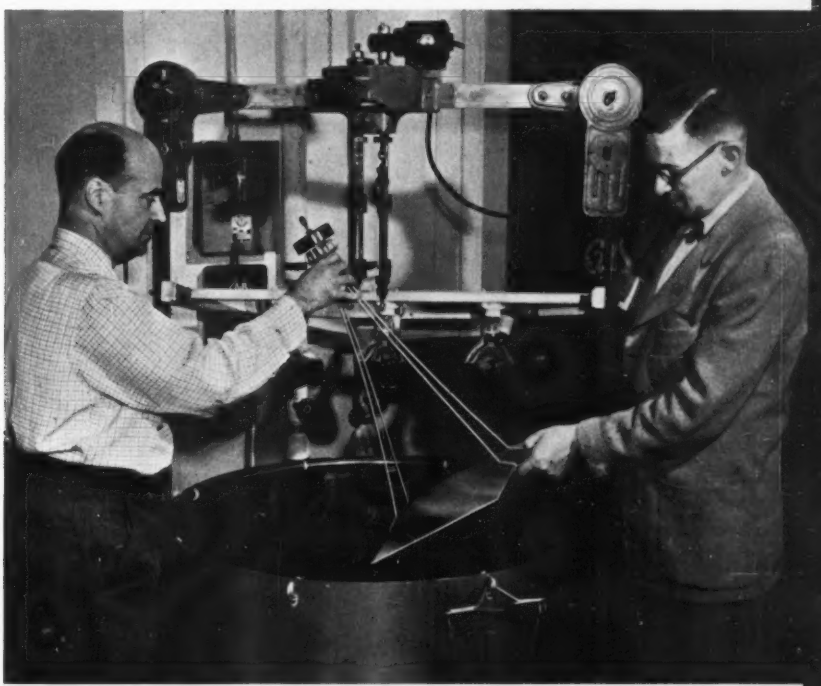


Fig. 1. After enamel has been brushed on the copper plate, the plate is attached to a wire hanger for whirling in a tank at a moderate rate of speed

ELECTRICAL circuits ordinarily consist of series of insulated copper wires connected to terminals. In circuits commonly found on complicated machinery there are myriads of terminals and hundreds of wires. The wiring of panel boards for such applications becomes a time-consuming task, and there is always the danger of making wrong connections.

Electrical circuits are now being made by a number of radio and television manufacturers through a copper etching process which enables the elimination of numerous wires. Even the most complex circuits can be produced almost as simply as printing a photograph from a negative. The Boeing Airplane Co., Seattle, Wash., has adopted this process for making electrical panel boards of a wide variety. On these panel boards there are strips of permanently attached copper which connect various terminal points and thus serve as a satisfactory substitute for wires.

These electrical circuits eliminate the danger of incorrect connections, save many hours of wiring time, and result in assemblies that are extremely neat in appearance. Typical circuit boards of the kind to be here discussed cannot be illustrated because of security regulations. However, it can be mentioned that copper lines for conducting electricity can be produced so close together by the method to be described that they give the appearance of a smooth surface to the naked eye and yet each line constitutes a separate circuit. An added advantage of the process is that circuits of extremely small size can be produced with ease.

The first step in the process is the development of a full-scale engineering drawing which shows all lines in the circuit in the desired relation to each other. This drawing is photographed on a negative, which consists of a stiff sheet of Vinylite-base film that is not subject to distortion. The circuit appears on the black negative in the form of transparent lines.

The next step is to transfer the negative image to a copper plate which is bonded to one side of a piece of phenolic electrical insulation board. The board is about 1/16 inch thick and the copper veneer is 0.003 inch thick. Phenolic boards up to 21 inches long by 18 inches wide can be handled by the equipment installed.

The copper plate must be coated with a light-sensitive bichromate shellac or enamel called "Tuftop." After this enamel has been brushed on the plate, the latter is immediately placed in a

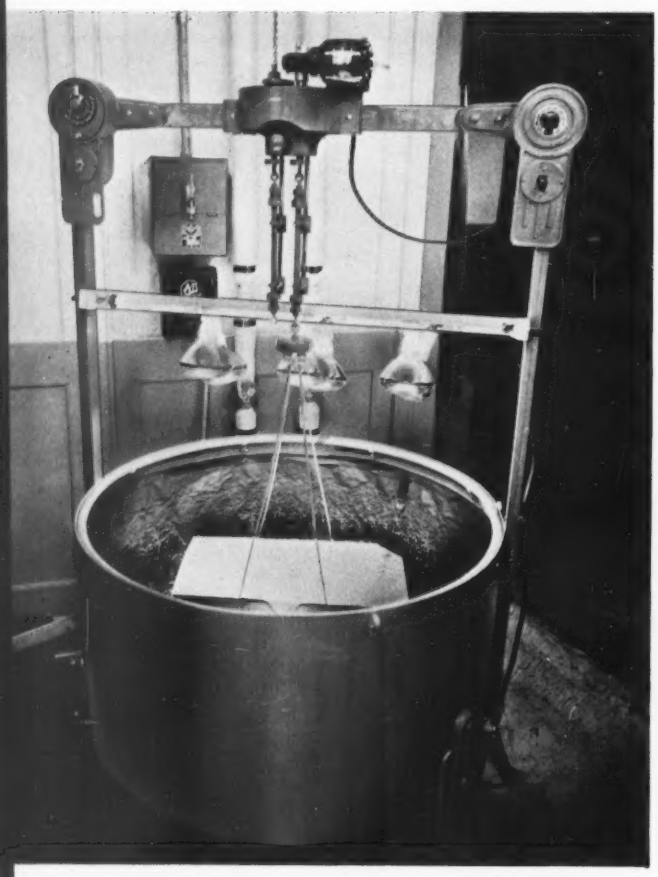


Fig. 2. Equipment employed for whirling the copper plate and for drying it by means of six infra-red lamps

wire hanger, as seen in Fig. 1, and then suspended from a revolving spindle on the machine shown in this illustration and also in Fig. 2. A small motor on top of the machine drives this spindle at a speed of about 50 R.P.M. to whirl the plate around in a horizontal plane within a tank that collects the excess enamel. The operation spreads the enamel evenly over the copper plate. At the same time, a battery of six infra-red lamps attached along a bar above the tank thoroughly dries the enamel.

When the copper plate has been prepared as described, the photographic negative of the circuit is placed over the plate within the vacuum type printing frame seen in Fig. 3. The glass cover of this frame holds the copper plate and negative in close contact with each other. Care must be taken to insure that no piece of lint or other extraneous substances are on the negative which might photograph as connecting lines on the copper plate and result in connections on the finished panel that could cause short circuits. Hence, the photographic negative is wiped clean with a "Staticmaster" brush.

After the glass cover of the vacuum printing frame has been closed, the frame is tilted in the manner shown in Fig. 4 until it is completely vertical and faces directly a 95-ampere arc lamp contained in the unit, seen at the left in the illustration. This lamp throws a glaring blue light on the negative which is stopped by black portions of the negative but goes through the white lines of the wiring diagram. As a result, the enamel beneath all lines becomes hardened. The exposure lasts approximately four minutes.

The copper plate is next immersed in a purple-colored alcoholic developing solution to re-

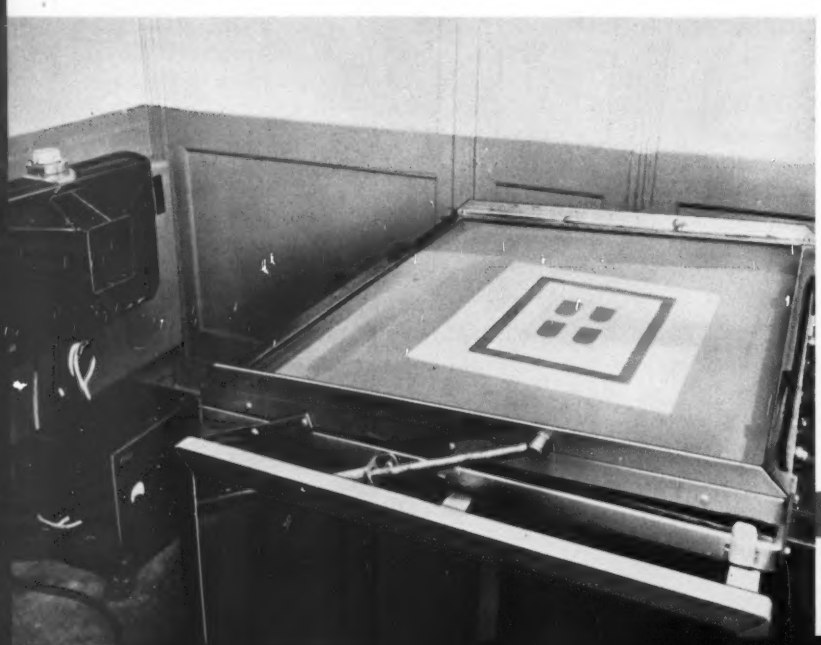


Fig. 3. An arc lamp unit and vacuum type printing frame which are used for transferring electrical circuit diagrams from a photographic negative to the copper plate

Fig. 4. Swinging the vacuum type printing frame into a vertical position so that the light from the 95-ampere arc lamp will be thrown directly on the photographic negative

move all portions of the enamel which were not hardened. The lines of hardened enamel are now purple in color and form the desired wiring diagram on the copper plate.

A view of the machine which contains the enamel developing solution is shown in Fig. 5. A copper plate is being placed on a vertical rack which will then be dropped into the narrow tank of alcoholic solution directly beneath. The solution is maintained at a temperature of between 75 and 90 degrees F.

After removal from the enamel developing tank, the copper plate is immersed in the etching tank seen in the heading illustration, which contains a ferric chloride solution for dissolving all of the copper except the lines that are protected by the purple-colored enamel. These lines are preserved so that the wiring circuit remains in copper on the phenolic board.

The boards are next sent to the machine shop where holes are drilled through them as required for the attachment of various electronic devices such as small radio tubes, condensers, and resistors. These parts are fastened to the back of the board opposite the side which has the copper circuits. Pins for attaching the electronic devices are inserted through the drilled holes, and then the entire board with pins is dipped into a solder bath for soldering all connections at one time, without even blurring the finest copper lines.

Fig. 5. Placing a developed copper plate on a rack for immersion into a tank of alcoholic development solution to remove enamel that has not been hardened

Power Recovery Wheels for Curtiss-Wright "Turbo-Compounds"

By EDGAR ALTHOLZ
Associate Editor

A TWENTY per cent bonus in aircraft piston-engine power—available in the form of higher speed or longer range—is provided by the new Cyclone turbo-compound power plants manufactured by the Wright Aeronautical Division, Curtiss-Wright Corporation, Wood-Ridge, N. J. With better than 300,000-hour service experience, mostly in Navy P2V's and P5M's and Air Force C119-H's, already accumulated, turbo-compounds are being introduced on commercial air lines in Lockheed Super Constellations and Douglas DC-7's.

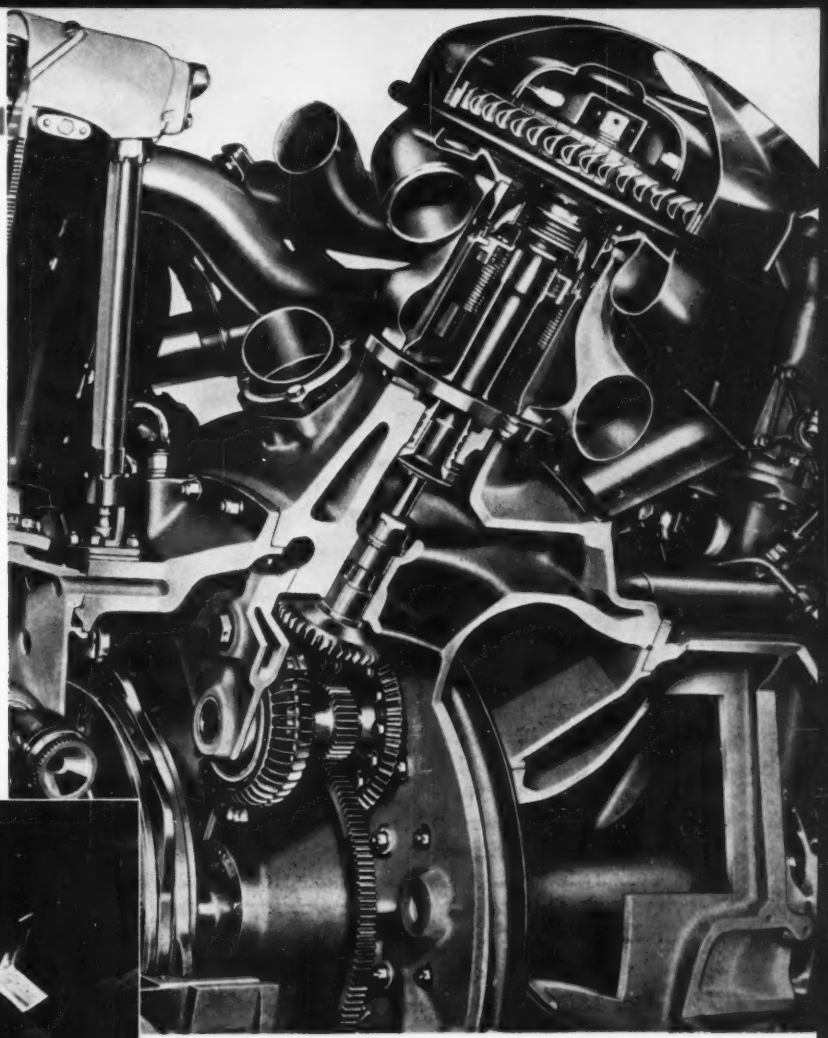
Three turbines, incorporated in the design of the well-known Cyclone eighteen-cylinder air-cooled radial engine, operate on the principle of an undershot water wheel. As such, they utilize the normally wasted energy in the exhaust gas. The gas, leaving the cylinders at sonic velocity (22,000 feet per second) is absorbed by the turbines, which are geared to the crankshaft, thus returning the energy as increased engine power. The turbines turn automatically through fluid-coupling linkage with the rotation of the crankshaft, functioning at take-off as well as at any altitude of flight. No additional controls or instruments are needed in the airplane, and no special training or attention during flight is required of the crew.

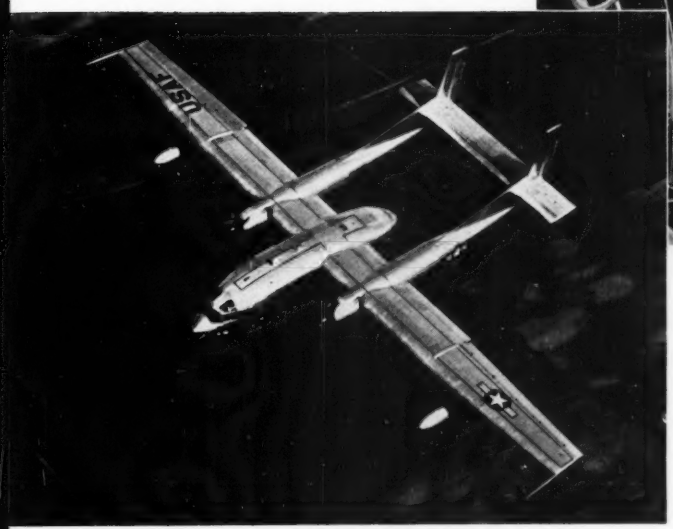
There are two nine-cylinder rows in the engine. Piping is so arranged that six cylinders, three in each row, feed one turbine. The three turbines are grouped radially 120 degrees apart. In absorbing the entering gas, the turbine, or power recovery wheel, is caused to turn very rapidly (16,000 R.P.M. at cruising speed). Energy is returned to the crankshaft through a splined quill, fluid coupling, and reduction gears. To cool the turbine, ram air is drawn in through a duct at the cowl seal and is directed to an impeller on the turbine wheel shaft. The air is forced by the impeller through holes between the butt ends of the turbine blades. Air and exhaust gas pass through the blades and are vented from a collector chamber.

Manufacture of the turbine wheel, shown separately in Fig. 1, entails a series of precision-welding, machining, and balancing operations. The wheel hub is a forging of Inconel "X"—a corrosion-resistant nickel-base alloy. The blades, or buckets, as they are referred to, are precision investment castings of Stellite 31, a tough cobalt-base non-ferrous alloy. A group of three of the buckets is shown in Fig. 2. Recesses are cast in the convex and concave surfaces at the butt ends. When assembled, they form holes through which cooling air passes. Each turbine wheel is a welded assembly of fifty-eight buckets around a hub.

In the initial phases of fabrication at the Curtiss-Wright plant, the buckets undergo a series of grinding operations before welding. At their butt end the buckets seat each other, and for the fifty-eight buckets to form a circle, all mating surfaces have to be ground at an angle that leaves the surfaces radial when assembled. One of the grinding operations is illustrated in Fig. 3.

Here, the butt end of the bucket's convex surface is being ground. Approximately 0.020 inch of material is removed in the operation, performed on an Arter rotary surface grinding machine. The work-table, turning at a speed of 30 R.P.M., feeds upward to the spindle, which is running at 1900 R.P.M. Twelve buckets at a time are accommodated in the fixture. Each bucket has a three-point location on its airfoil,





Fairchild C-119 Packet

with a pair of small jacks to support its under surface. Tolerances of plus or minus 0.002 inch are maintained from the imaginary center line of the airfoil.

Following an inspection, the ground buckets are ready for arc-welding to the forged hub. Assemblers arrange the buckets around one of the hubs in a circular box type fixture. In Fig. 4 can be seen the welding set-up, with the fixture supported on the table of a Ransome positioner. Two welders using Lincoln equipment together lay down the bead. With the positioner tilted to permit a down-hand weld, it rotates slowly, by means of a motor and reduction gears, under the control of the foot-switch next to the welder on the right.

Six passes are made around each side of the turbine wheel. After every pass the wheel is removed from the fixture and the bead is ground down. The subsequent bead is then laid down over the ground layer.

The buckets of the welded wheel are examined on an alignment fixture. Those found to be out-of-line because of welding distortion are peened with a portable air hammer. The procedure may have to be repeated several times. Normalizing and Zirconite (sand) blasting follow, and the leading edge of the airfoil is inspected.

In the welding of the buckets to the hub, a dam of the deposited material accumulates in

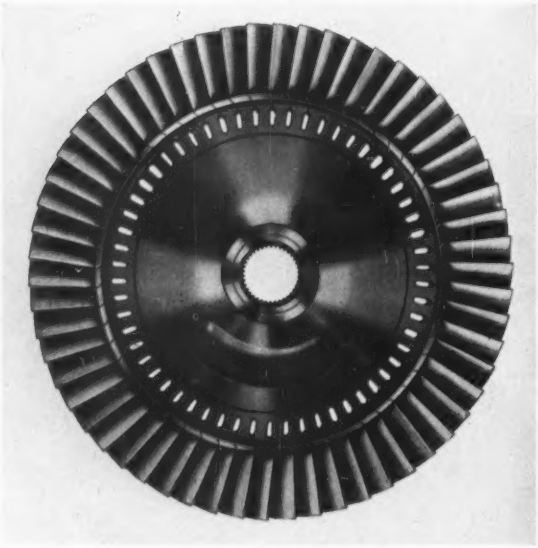
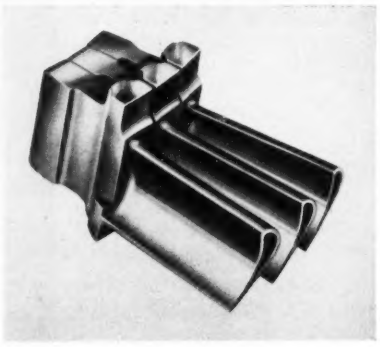


Fig. 1. (Left) The turbine wheel is a welded assembly of cast buckets and a forged hub.

Fig. 2. (Below) The buckets seat each other, forming vent holes when assembled.



the areas adjacent to the seam. This dam is removed from the sides of the wheel in a facing operation on a LeBlond engine lathe. An X-ray inspection follows, particular attention being given to cracks and flaws in the welding areas.

In the next step, the wheels are supported on three-point locating fixtures over magnetic chucks on other Arter rotary surface grinding machines, to establish the flatness of both bucket rim faces. Approximately 0.1 inch of metal is ground off.

Boring, counterboring, facing, and chamfer-

Fig. 3. Before being welded to the hub, buckets undergo a series of surface grinding operations.

Fig. 4. A box type fixture maintains the assembly intact as two operators arc-weld the turbine wheel.

Fig. 5. In contouring the web, the carriage is left unclamped, and the pressure of the bumper (B) maintains the follower (D) in contact with the cam (A).

ing the hub hole are performed by means of a square-turret cutter set-up on a 16-inch American engine lathe. The hole is "picked up" from the outer rim. (All subsequent operations are located from either the machined bore or counterbore.) Another American engine lathe faces and chamfers the back of the bore, after which the bore and counterbore are finished on a Heald internal grinding machine.

The hub web, between the buckets and the bore face, is then contoured in the operation shown in Fig. 5 on a Warner & Swasey 2A saddle type turret lathe. One of the hexagon-turret stations is set up with a cam *A* of the required contour, and a spring-loaded bumper *B* is fitted over the end of the master stop-rod for the carriage. The view shows the operator advancing the saddle to a pre-set stop, at which point it will be locked in position.

At the same time, the operator advances the carriage toward the spindle, against the pressure of the bumper, until the carbide cutter *C* has entered the web area of the work, which is rotating slowly. With the carriage left unclamped, the cross-slide is fed in automatically. Bumper pressure causes the carriage to retract sufficiently to maintain a follower *D*, which is set up in the square turret, in contact with the cam. This motion produces the web contour. A light cut is taken at the same setting by feeding out; the bearing of the follower against the cam simultaneously forces the carriage toward the spindle.

No attempt is made on the turret lathe to machine the section of the web contour extending into the bucket area, because of the heavy burrs that would be left in the vent holes by the cutter. Instead, this section is blended into the completed part of the contour on the Heald in-

(*Continued on page 218*)

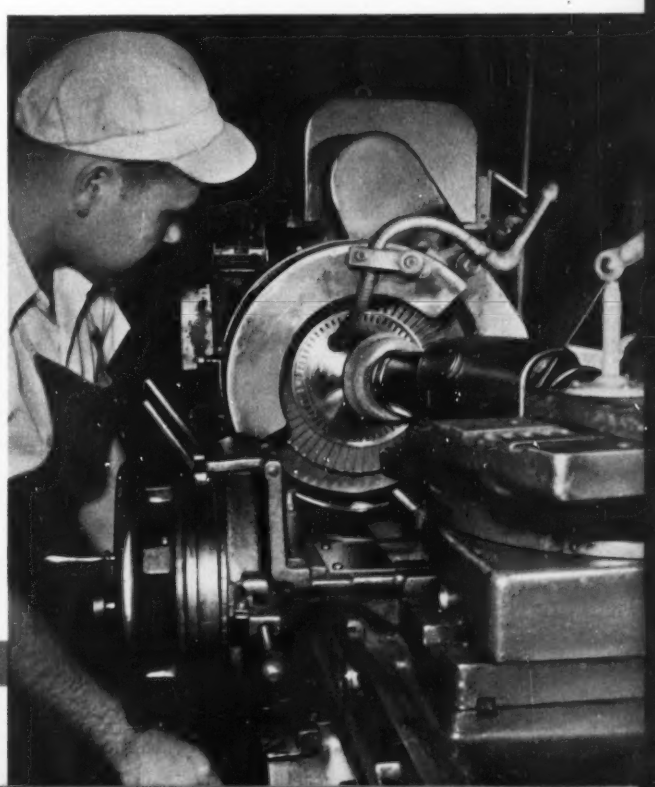


Fig. 6. This operation combines grinding the bucket area of the web and the inside diameter of the bucket rim.

Unique Drilling Duplicator Developed by Northrop Tool Engineers

By LUDWIG DONNER

Assistant Superintendent of Tool Engineering Design and Standards
Northrop Aircraft, Inc., Hawthorne, Calif.

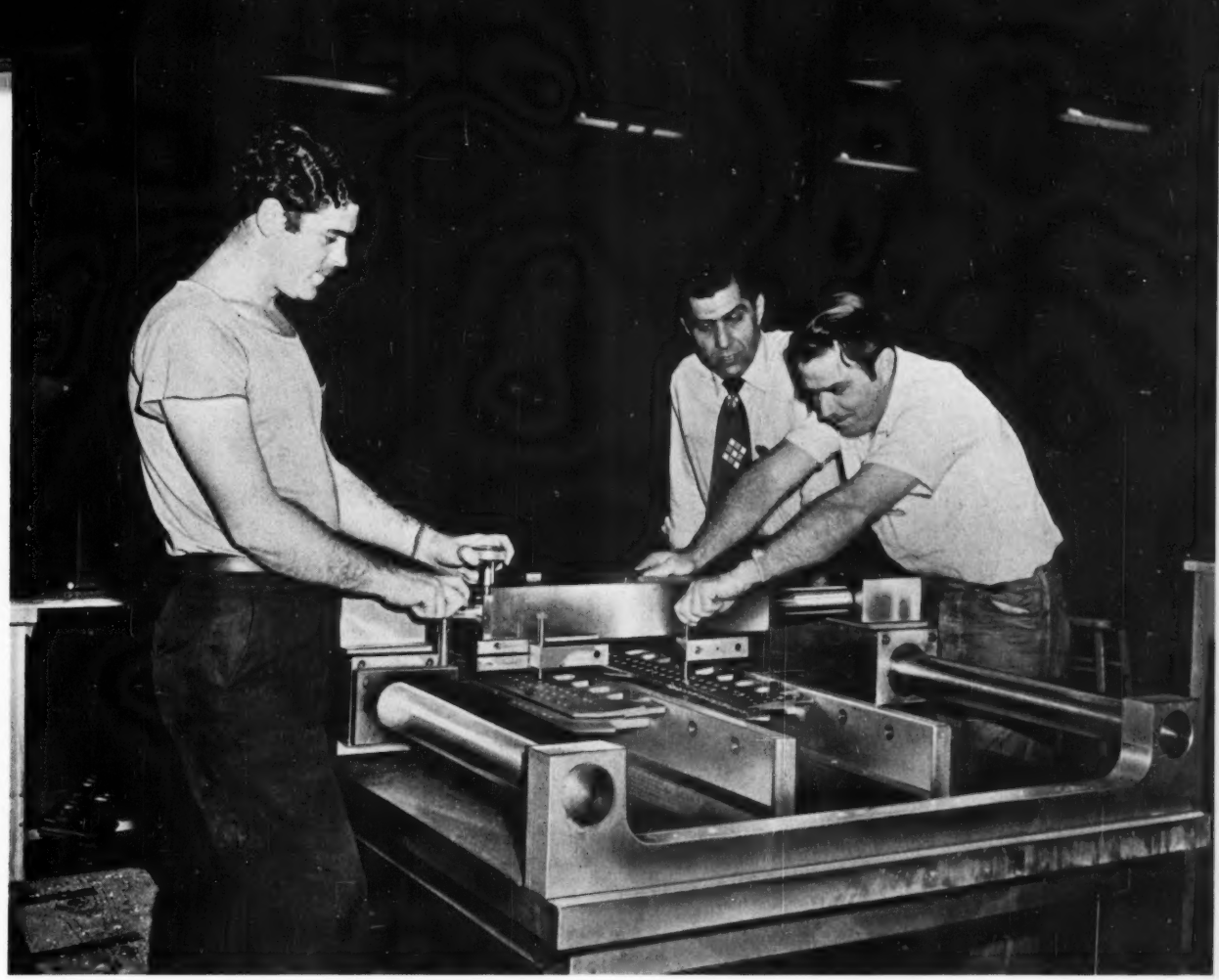
SUBSTANTIAL savings in time and costs were achieved in the modification of Scorpion F-89 all-weather interceptors through the use of an ingeniously designed fixture which enabled the accurate duplication of rivet and bolt holes in replacement parts by using the original parts as templates. The fixture was specifically developed for drilling wing attachment angles, but it can be applied to a variety of work. Holes that are drilled vertically or at any angle can be duplicated within an accuracy of 0.001 inch as to center distances.

The original work-piece which is to serve as a template is mounted on a master bar *A* on the left-hand side of the fixture, as seen in Fig. 1, and the new piece to be drilled is similarly mounted on the right-hand master bar *B*. These master bars are provided with accurately located bushings which match attachment holes on the work-pieces and on the airplane wings. The work-pieces are held stationary throughout the drilling operations.

Above the work-pieces is a carriage mounted on two highly finished tubes *C* located on opposite sides of the fixture base. The duplicating unit can be readily moved from the front of the fixture to the back, and vice versa. The lengthwise running tubes are 3 inches in diameter. A clamp *D* on the left-hand slide *E* of the unit provides for locking the entire unit in any desired position along the tubes.

There is a cross-slide *G* on a 2-inch diameter tube that extends crosswise on the fixture, the opposite ends of this tube being rigidly attached to slides *E* and *F*. On slide *G* there is a holder *H* for a dowel-pin which is successively entered

Northrop F-89 Scorpion
All-Weather Interceptor



into the holes of the original piece or template. (This operation can be seen in Fig. 2.) With each positioning of the dowel-pin, a drill bushing in holder *J* is automatically located in the same relative position above the work-piece to be drilled as the dowel occupies on the template. Consequently, any hole drilled in the work-piece will be in proper relationship with all other holes to be drilled. The dowel-pin is locked in various settings by tightening knob *L* of a clamping screw.

The top surfaces of the work-pieces and the original parts are cambered in different directions, and it is necessary to drill all holes exactly at right angles to the plane of the top surface at the exact points where the holes are located. Consequently, few of the holes are drilled at the same angle. For this reason, slide *G* is free to revolve on its axis, and both holders *H* and *J* are free to revolve on shafts which extend to the back of slide *G*. The rear ends of the two shafts are connected to each other through linkage *K*. Therefore, any angular movement imparted to holder *H* in placing the dowel-pin in any hole of the template is likewise imparted to holder *J*, so that the drill bushing in this holder is positioned at the same angle from vertical as the dowel-pin.

Easy movement of slides *E* and *F* along their tubular arms is obtainable because the slides are mounted on rollers. Slide *E* is provided with three rollers *L*, 1 inch in diameter by 1/2 inch in width, which are located two on top of the tubular arm and one beneath the arm, as shown diagrammatically in view X, Fig. 3. Slide *F* is supported on four rollers arranged in pairs, one pair being located on each end of the slide. View Y, Fig. 3, shows the arrangement of these rollers at *M*. They also are 1 inch in diameter by 1/2 inch in width. The cross-slide is provided with bushings at each end to permit free swiveling on the tube on which it is mounted. The large base of this fixture is an aluminum casting, which makes the equipment readily portable. The work-pieces handled by this duplicator are generally made of 75S-T aluminum alloy.

For stainless-steel drilling, particularly in drilling deep holes and employing portable hand

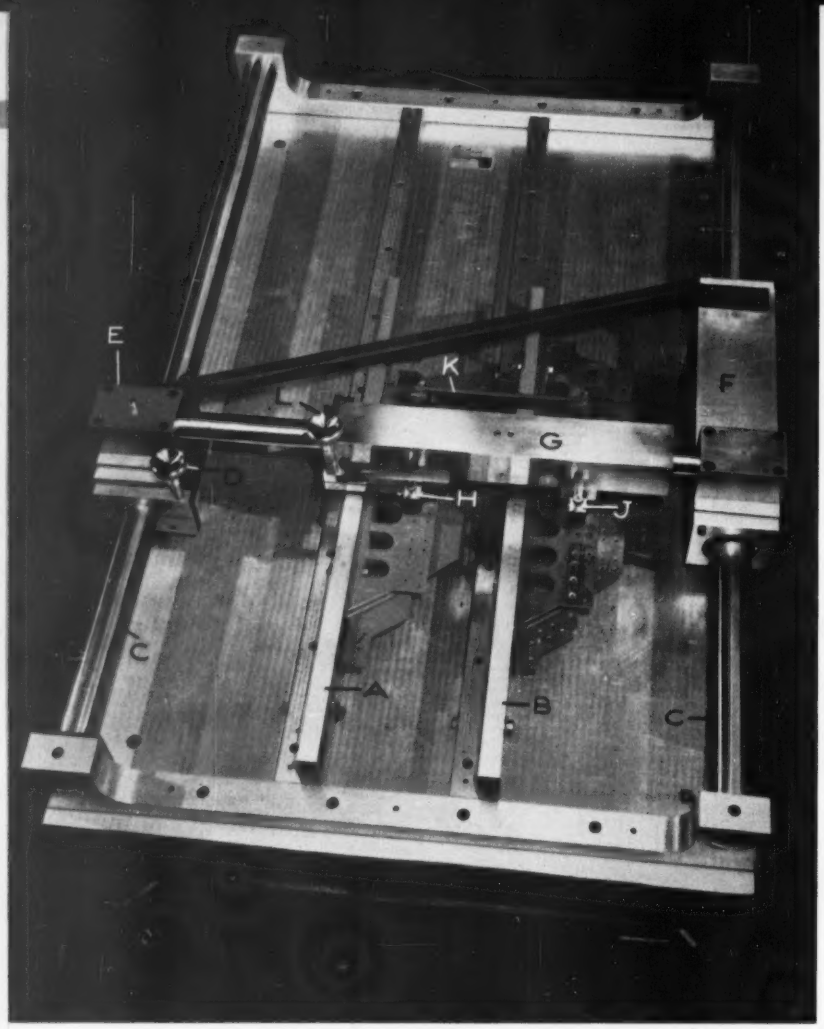


Fig. 1. (Left) Three-dimensional drilling duplicator developed to insure the exact duplication of drilled holes, so far as both location and angularity are concerned, in aircraft parts

Fig. 2. (Below) Lining up the dowel locating pin of the duplicating unit in one of the holes in the original work-piece

tools, use is made of a special "Nortwist" drill designed by Northrop engineers. The principal feature of this drill, illustrated in Fig. 4, is a tapered web which provides additional strength along the drill body while allowing normal chip clearance at the tip or cutting edges. The minimum web thickness at *D* is made equal to one-fifth of the nominal drill diameter, while the maximum web thickness *H* is made one-half the nominal drill diameter.

Length *E* of the tapered web portion is made equal to three-fifths of the American Standards Association's flute length for twist drills. Length *F* of the straight web section is made equal to two-fifths of the Association's flute length for twist drills.

These drills have been made in the following sizes: No. 40, No. 30, No. 21, and No. 10. They are made of high-speed steel, with two flutes which are ground to a split point—as seen in the end diagrams of Fig. 4, above the drawing of the full drill. At the speed of 1500 R.P.M., customarily used with these small drills on stainless steel, few burrs are left on the work for removal after drilling.

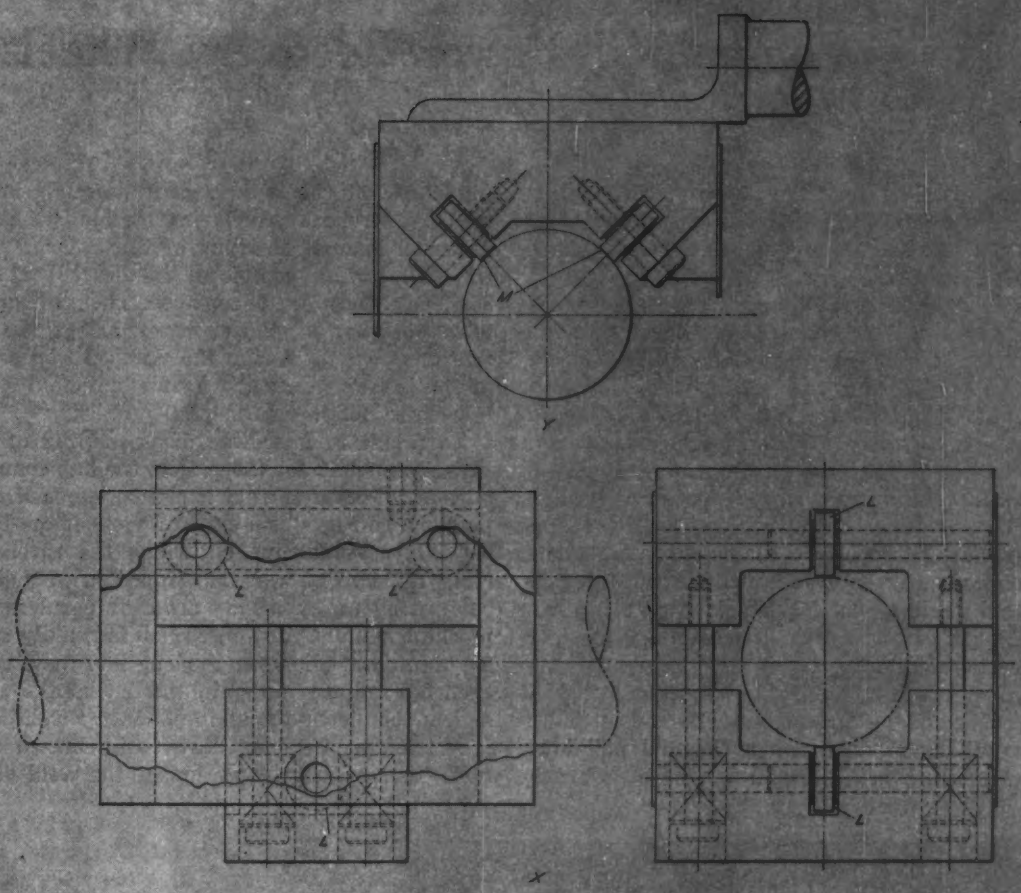


Fig. 3. Diagrams showing the location of rollers that facilitate movement of the two duplicator slides along their tubular arms

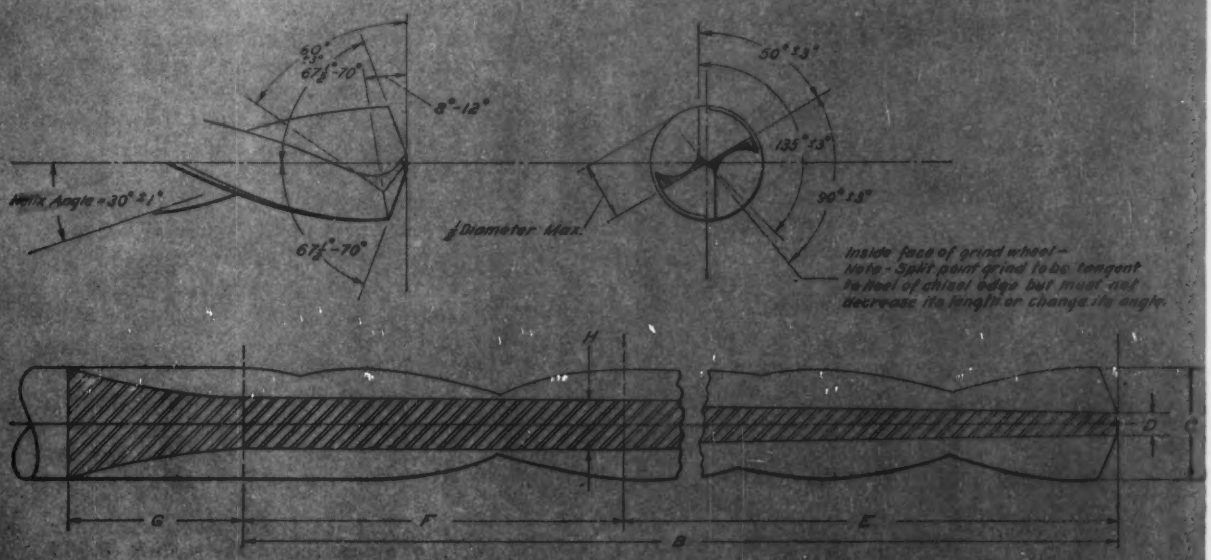


Fig. 4. Two-fluted twist drill with tapered web and split point, which was designed especially for drilling stainless steel

"Turbo-Compound" Power Recovery Wheels

(Continued from page 213)

ternal grinding machine shown in Fig. 6. In addition to finishing the contour, the grinding wheel at the same time finishes the inside diameter of the bucket rim.

Although the straight portions of the grinding wheel can be dressed by diamonds on the machine, the operator has the skilled job of manually dressing the contour portion to a template. This is done without stopping the rotation of the wheel by having the wheel cut a piece of cardboard, then fitting the cardboard to the template and dressing at necessary points.

The final grinding operation consists of finishing the rim outside diameter on an Arter machine. After this, the work is carefully deburred with a small portable air tool, given a Tampico brushing on a polishing jack, and inspected again.

The 38-tooth spline in the hub bore, by which the energy of the turbine wheel is transmitted to the quill, is broached on a Colonial pull-down machine. In Fig. 7, the operator is shown brushing chips off the broach as it descends in its working stroke. A retrieving mechanism eliminates all manual handling of the broach. With the tool having completed its descent at the semicycle, the work is removed. Then, by means of a push-button, the operator brings the retriever down to engage the notched upper end of the broach. A cutting agent, Metalloid X-30, is used to obtain a high-quality finish.

To facilitate in-service disassembling of the turbo-compound for inspection, the hub counterbore is threaded so that it can be engaged by a pull-rod. In Fig. 8 is a close-up view of the Hanson-Whitney machine on which the thread is climb-milled. The work is gripped on its splined surface by an expansion arbor integral in the machine spindle. A 12-pitch hob is rapidly traversed into the hole up to the length of the thread, then fed radially to depth, and out, as the work slowly completes one and one-tenth revolutions.

A twenty-four hour heat-treatment, an acid etch, and another inspection of the weld areas

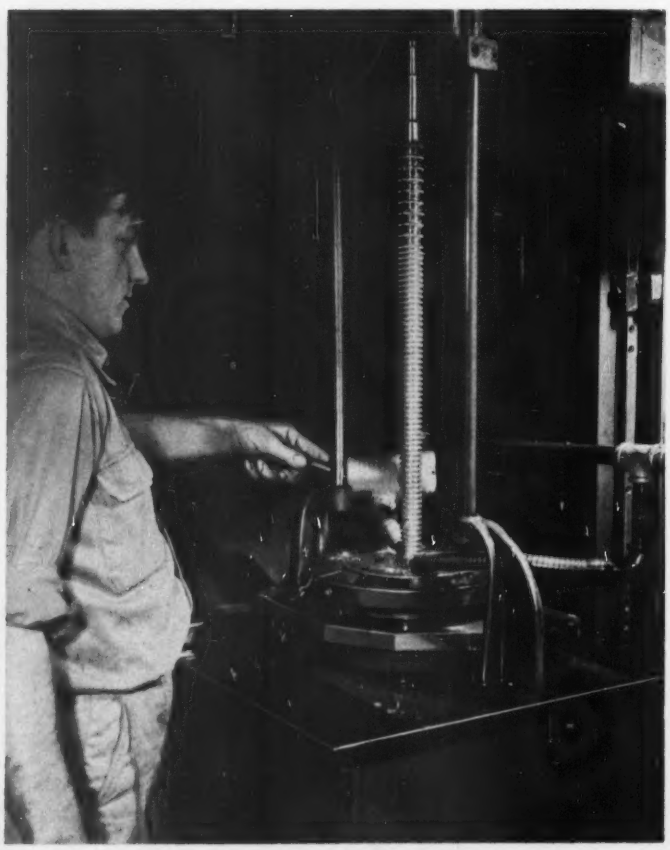


Fig. 7. Each broach tooth increases the diameter of the spline 0.003 inch. The toughness of the hub metal requires a relatively low broaching speed.

Fig. 8. The thread being milled in the counterbore facilitates in-service disassemblies of the turbo-compound.

follow. An important operation, balancing the turbine wheel, is then performed on Gisholt Type S Dynetric machines. This operation is illustrated in Fig. 9. The turbine wheel *A* rotates at 2000 R.P.M. on rollers *B* of a frame *C*. This frame, made of aluminum, is suspended from wires *D*.

Unbalance in the work sets up vibrations in the frame which are transmitted through wires *E* to pick-up coils in the field of permanent magnets *F*. The motion of the coils in the field generates an alternating voltage in the coils proportional to the magnitude of vibration, and is directed through wires *G* to an amplifying unit in cabinet *H*. The amplified voltage can then be read on sensitive meter *J*.

Controls for obtaining the readings for the amount and angle of unbalance correction are grouped on switchboard *K*. Stroboscopic lamp *L* indicates the angular location of the unbalance by flashing for approximately ten-millionths of a second each time the voltage generated in the pick-up coils changes from negative to positive. From the flashing of the lamp, one of the numbered graduations on a collar rotating with the work appears to stand still, indicating the angular location of the unbalance to be at this point.

The rotation of the work is stopped, and small wads of clay are built up on the face of the turbine wheel diametrically opposite the unbalance point. The work is again rotated, and if necessary, more or less clay is used until, through trial and error, no unbalance is indicated. Then, the work is taken out of the balancing machine, and the clay removed and carefully weighed.

From an available assortment of small arc-shaped steel templates, one template is selected that is equal to the weight of the clay. The wheel is brought to a Gorton profiling machine, and an area equal to the size and thickness of the template is milled at the unbalance point. If additional correction is needed after a recheck on the balancer, it can ordinarily be obtained by hand polishing the work at the unbalance point.

A 100 per cent inspection of the turbine wheels is made after the balancing operation. Then, in a whirl test, the wheels are placed in an armored container and run at 28,000 R.P.M.—a speed considerably higher than is developed in actual service.

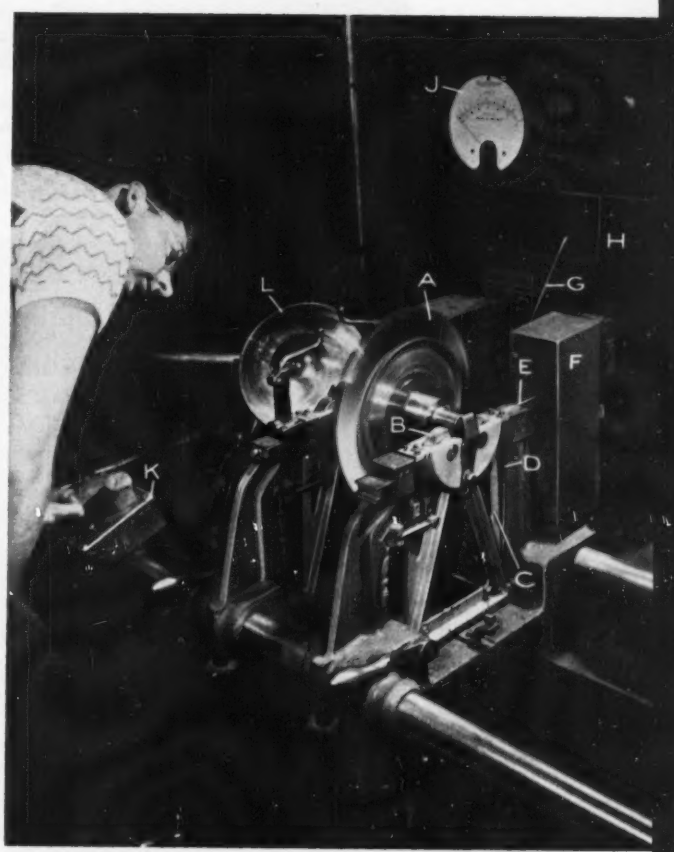


Fig. 9. The number indicating location of unbalance appears to stand still upon flashing of the stroboscopic lamp.

Machinery's Handbook Reaches the Million Mark

Chester L. Phillips, purchaser of the millionth copy of MACHINERY'S HANDBOOK (right); Robert B. Luchars, president of The Industrial Press (center); and Franklin D. Jones, co-author of MACHINERY'S HANDBOOK (left). A portrait of Alexander Luchars, founder of The Industrial Press, is seen in the background.

AN event of considerable interest in the engineering field occurred on June 5 with the sale of the millionth copy of MACHINERY'S HANDBOOK in the main office of The Industrial Press, New York City, publishers of the HANDBOOK, and also of MACHINERY, *Heating and Ventilating, Heating & Plumbing Equipment News,* and a wide variety of technical books. It is believed that no other handbook of engineering published anywhere in the world has ever closely approached such a sales record.

MACHINERY'S HANDBOOK was first published in 1914, and was an immediate success due to the need at that time for accurate technical information by manufacturers in this country and abroad who were engaged in the production of munitions for World War I. Erik Oberg and Franklin D. Jones were co-authors in the preparation of the volume that soon became internationally famous. According to the latest count, the HANDBOOK is being used in seventy-seven countries throughout the world.

The HANDBOOK has been published in fourteen editions, each of which has been extensively revised to keep abreast of technological advances in the manufacturing industries. Until the retirement of Mr. Jones on January 1, 1950, all revisions were under his direction; since that time, revisions have been conducted under the supervision of Holbrook L. Horton, the book editor.

Chester L. Phillips, in charge of process engineering at the Glenn L. Martin Co., Baltimore, Md., lucky purchaser of the millionth copy of MACHINERY'S HANDBOOK, and his wife were invited to New York City by the publishers to help celebrate the occasion. The millionth copy, suitably bound and inscribed, was handed to Mr. Phillips by Robert B. Luchars, president of The Industrial Press. A commemorative copy was presented to the co-author, Mr. Jones.

High-Speed Turning Research at Jones & Lamson

TO determine whether steel could be turned at much higher rates of speed, a research and development program was set up in 1945 by the Jones & Lamson Machine Co., Springfield, Vt. Three 16-inch Fay lathes, powered with 75-H.P. motors, were built for conducting the tests. A New Departure ball bearing outer race, made from a forged ring of S A E 52100 steel, was selected as the work-piece.

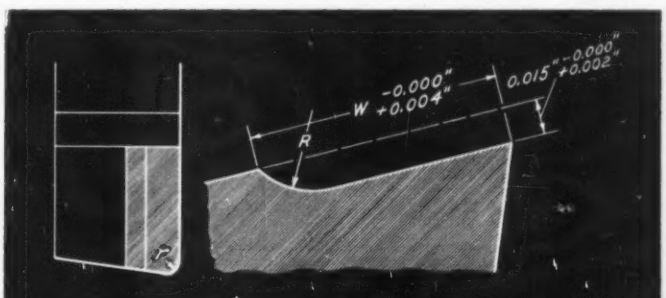
It is believed that 250 to 300 surface feet per minute was the maximum cutting speed that had been used for turning this steel up to that date. After running exhaustive tests it was determined that the most satisfactory speed for cutting this particular alloy was between 600 and 700 surface feet per minute. Since that time, these figures have been confirmed in actual production operation.

The research program has shown that with high-speed turning it is possible to cut or separate a given amount of metal with less horsepower, and produce a better finish, higher accuracy for diameter and concentricity, and less distortion of the surface structure of the finished work-piece.

By using the proper clearance and rake angles of the cutting tools, together with the proper cutting compound, it is possible to turn S A E 52100 steel at between 600 and 700 surface feet per minute and obtain white chips. Both the work and the tool will be cool, and the chip will be white. In turning any steel, if this "white chip" range can be found, cutting tool life and the number of pieces produced per grind of the cutting tools can be materially increased. Also, the appearance of the turned part is a good indication of whether the cutting speed is high enough. A dull, gray turned surface usually indicates that the cutting speed is too low, while a bright sheen generally means that the cutting speed is satisfactory.

For the next step in the research and development program, a Ford rear-axle driving pinion forged from S A E 8620 steel was selected. After conducting various tests, the cutting speed was increased to approximately 1200 surface feet per minute on the outside diameter of the bevel gear with a feed of 0.015 inch per revolution. Here again, a speed and feed range was found that gave white chips. It was noted that by increasing the cutting speed 33 1/3 per cent—from 900 to 1200 surface feet per minute—the horsepower requirements increased only between 9 and 10 per cent. Although the forgings ran out from 1/32 to 1/4 inch when they were placed between centers preparatory to turning, the finished piece ran continuously inside of 0.002 inch. An important observation from these high-speed turning tests was that the grain structure remained as it was when the forging was made—right up to the surface of the piece. In contrast to this, when the part was cut at slow speeds, the surface of the finished work-piece was damaged by distortion.

The components of tool loads are measured by using resistance-wire strain gages that were bonded to a special tool-holder and a small cantilever beam in such a way that radial, tangential, and feed forces can be determined. Three sets of



TOOL NO.	NOSE RADIUS r, MAX. INCH	CHIP BREAKER DATA: FILLET RADIUS, R INCH	CHIP BREAKER DATA: WIDTH, W INCH
1	1/64	0.035 TO 0.050	0.050
2	1/32	0.035 TO 0.060	0.076
3	1/16	0.035 TO 0.090	0.122

Fig. 1. Proposed chip breakers for single-point, general-purpose, carbide-tipped tools based on a two-year research project conducted at Cornell University, sponsored by twenty-seven machine tool manufacturing companies

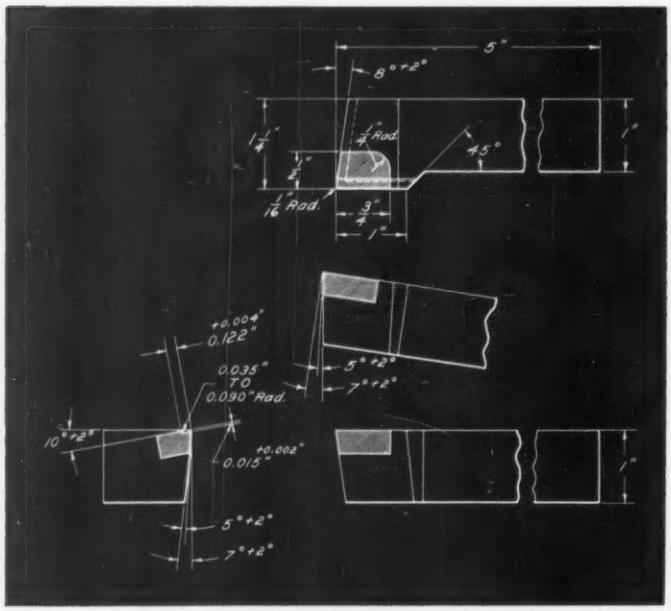


Fig. 2. Tool used in testing chip breaker. Good results were obtained in turning both carbon and alloy steels at speeds ranging from 250 to 500 surface feet per minute and feeds of 0.011 to 0.022 inch per revolution.

strain gages on the tool-holder are connected to universal analyzers and direct-inking oscillographs, which make simultaneous records. Numerous tests have shown that the tangential and feed forces are reduced as the cutting speed is increased up to 600 feet per minute. Then, these forces remain practically constant as the cutting speed is further increased.

Another example of high-speed turning is in producing body-bound steel bolts that are turned, faced, threaded, and cut off in one operation from bar stock on a No. 3 J & L universal ram type turret lathe at 2000 R.P.M. All carbide tools are used, including carbide-tipped thread chasers. This bolt has been made at various times from S A E 1040, X-1315, and 8749 steels, and Type 303 stainless steel, using the same cutting speeds, which range from 380 to 720 surface feet per minute at 2000 R.P.M. To turn the body of this bolt in one cut from different materials required from 17 to 22 H.P. The body diameter of the bolt is held to a 0.001 inch tolerance in one cut, using a roller turner. White chips and exceptionally good tool life are obtained. An interesting fact in this operation is that stainless steel as well as low-carbon and high-alloy steels can be turned with no appreciable change in tool life, finish, or change in the rake angles of the cutting tools.

One point emphasized by the many tests is that the selection and application of a cutting compound are most important to successful high-speed turning, particularly for machining high-alloy steels, for taking heavy forming cuts, and in threading with carbide. However, in most intermittent cutting applications, it is better not to use a coolant. The air cooling of the tool between cuts in such applications is usually sufficient, and alternate heating and cooling of the tool with a coolant usually cause trouble.

Although general-purpose tools will usually be satisfactory for approximately 90 per cent of the jobs encountered, the remaining 10 per cent usually have to be tailored to fit the individual application. A recently completed two-year research project at Cornell University, sponsored by twenty-seven machine tool manufacturing companies, investigated the type and size of chip breakers recommended for cutting tools. One company that has tested the suggested chip breakers has approximately doubled the life of the cutting tools employed.

Feed Ranges for Tools Shown in Fig. 1 when Cutting Different Materials

Steel, AISI No.	Tool No.	Feed Ranges, Inch per Revolution			
		A	B	C	D
4140	1	0.005 to 0.0075	0.0075 to 0.009	0.009 to 0.012	0.012 to 0.015
	2	0.009 to 0.012	0.012 to 0.015	0.015 to 0.020	0.020 to 0.024
	3	0.015 to 0.019	0.019 to 0.023	0.023 to 0.030	0.030 to 0.036
C-1037	1	0.004 to 0.006	0.006 to 0.008	0.008 to 0.012	0.012 to 0.015
	2	0.008 to 0.011	0.011 to 0.014	0.014 to 0.019	0.019 to 0.023
	3	0.012 to 0.015	0.015 to 0.022	0.022 to 0.030	0.030 to 0.036
B-1112	1	0.002 to 0.005	0.005 to 0.007	0.007 to 0.010	0.010 to 0.012
	2	0.005 to 0.010	0.010 to 0.014	0.014 to 0.018	0.018 to 0.022
	3	0.009 to 0.018	0.018 to 0.025	0.025 to 0.030	0.030 to 0.036

Proposed chip breakers for single-point general-purpose carbide-tipped tools are shown in Fig. 1. These and other results of the Cornell research project will be published in book form, and a wall chart is being prepared for toolroom use. Feed ranges for the tools shown in Fig. 1, when cutting different materials, are given in the accompanying table.

One of the tools employed at Jones & Lamson to test the proposed chip breaker is shown in Fig. 2. For the tests, cutting speeds of 250 to 500 surface feet per minute and feeds of 0.011, 0.015, and 0.022 inch per revolution were employed. Depth of cut varied from 0.060 to 0.400 inch. Both carbon and alloy steels (including S A E 1141, 4145, and 8749 steels) were machined, and very good chip breaking was obtained in all cases.

Jones & Lamson engineers believe that industry will never reach higher levels in turning speeds without carrying on an educational program for the machine operators and mechanics who are actually doing the work in the shop. Such a program should include education on tool grinding, so that rake angles, clearance angles, and chip breakers are ground and maintained uniformly.

An interesting 16-millimeter sound-color motion picture on the research and development program and its results has been produced. The film, which runs for twenty-seven minutes, contains a series of high-speed motion pictures taken at 3000 frames per second when cutting AISI C1118 steel at various surface speeds up to 1200 feet per minute. The film is available to interested firms and engineering societies, and can be obtained by writing to the Jones & Lamson Machine Co., Springfield, Vt.

Model of an Atomic Plant for Producing Electricity

A NUCLEAR reactor, the first and only one in California, is now operating in the Atomic Energy Research Department of North American Aviation, Inc., at Downey. This department, conceived originally to investigate atomic energy as a propulsion medium for piloted aircraft and guided missiles, more recently has concentrated on the use of atomic energy as a primary fuel for producing electrical power. The project of designing and engineering an atomic plant for producing electricity has already been completed by the company, which recently exhibited a model of a proposed pilot plant. Necessary research and studies could be made in such a plant to fully develop the vast potential of electrical power from atomic energy.

The drawing, Fig. 1, gives an idea of how the pilot plant would function. Heat produced by atomic fission in the nuclear reactor would be absorbed by some such liquid metal as sodium passing through the reactor core. The liquid metal, piped to a water boiler, would then produce steam which, in turn, would drive a turbine generator to produce electricity. About 8000 kilo-

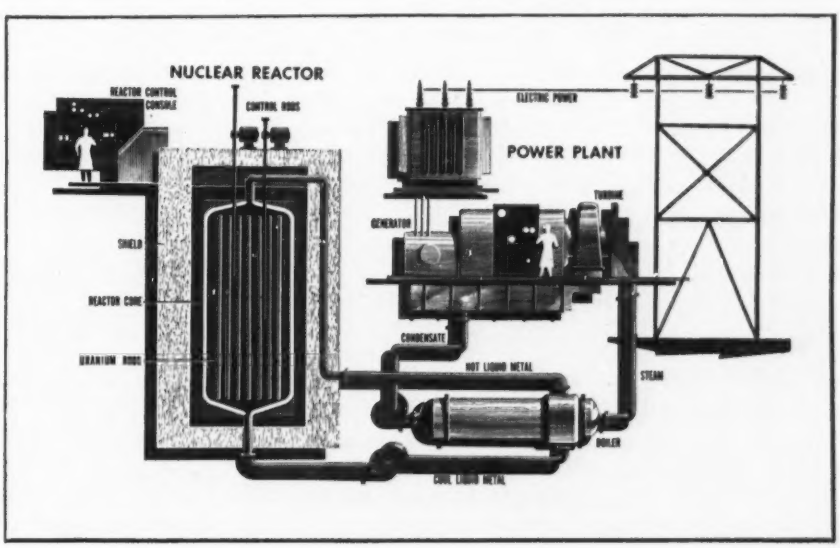


Fig. 1. In a plant producing electrical power by means of atomic fission, the heat of the nuclear reactor will be absorbed by a liquid metal piped to an ordinary water boiler to produce steam for the generator.

Fig. 2. (Left to right) Dr. Chauncey Starr, director of atomic energy research at North American, describes the scale model of the proposed pilot plant; looking on are J. L. Atwood, company president, and J. H. Kindelberger, board chairman and chief executive officer.

watts of electricity—enough for 2000 homes—could be produced for use in other atomic energy research to be done at the site of the reactor.

The scale model of the proposed plant, complete with flashing lights, moving control rods, and a Geiger counter, can be seen in Fig. 2. The estimated initial cost of atomic fission electricity is 14 mills per kilowatt-hour—double the present average rate. This differential should eventually be reduced by improved power-generating technology, which would undoubtedly stem from experience gained in the prototype installation, as well as by likely increases in rates of conventional facilities for generating electricity. Furthermore, in areas where coal, oil, gas, or water power is not economically available, atomic power plants would have a distinct rate advantage over other utilities.

* * *

Machine Tool Sales Conference to Be Held at Purdue

The ninth annual Machine Tool Sales Conference, directed by the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association, will be held from July 20 to 24 at Purdue University, with 160 individuals enrolled. The conference is open only to employes of the concerns belonging to the two associations.

Director Harry J. Loberg of the College of Engineering, Cornell University, will again be the educational director, and the faculty assignments will be filled from members of the associations, as well as from the faculties of Purdue, Cornell, and Western Reserve Universities, and Dartmouth College. The text used will be Director Loberg's *Machine Tool Selling*, a copy of which will be sent to each registrant before the course begins.

Applied Electricity

APPLIED ELECTRICITY—Second Edition. By H. Cotton. 482 pages, 5 1/2 by 8 1/2 inches; 387 diagrams. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N.Y. Price $4.50 (Canadian or foreign postage, 75 cents).

The author of this excellently arranged and unusually well written book has supplied a sound basis for understanding the theory of magnetism, electrostatics, and electromagnetism, and the theoretical and practical aspects of all types of electrical equipment. The treatment is such that a clear, easily scanned reference is provided for the electrical and the mechanical engineer as well as a comprehensive presentation for the student. The application of electrical theory to motors, generators, transformers, lighting devices, electronic equipment, and measuring instruments is thoroughly covered. Many examples are worked out in the text.

The volume originally appeared in London and was so well received there that now, a year later, a second edition is being published both in England and the United States. A comprehensive account of the meter-kilogram-second (M.K.S.) system of units has been included in this second edition, as well as new sections on the triode tube and the photocell.

The following subjects are covered: The Electric Circuit; Magnetism; Electrostatics; Conduction in Electrolytes; Thermoelectricity; Direct-Current Machines; Direct-Current Generators; Direct-Current Motors; Alternating Currents; Alternating-Current Circuits; Electrical Resonance; Polyphase Working; Static Transformers; Alternators; Synchronous Motors and Rotary Converters; Induction Motors; Electronics; Illumination; Measuring Instruments; Units and Dimensions; and Circle Diagrams.

TOOL ENGINEERING *Ideas*

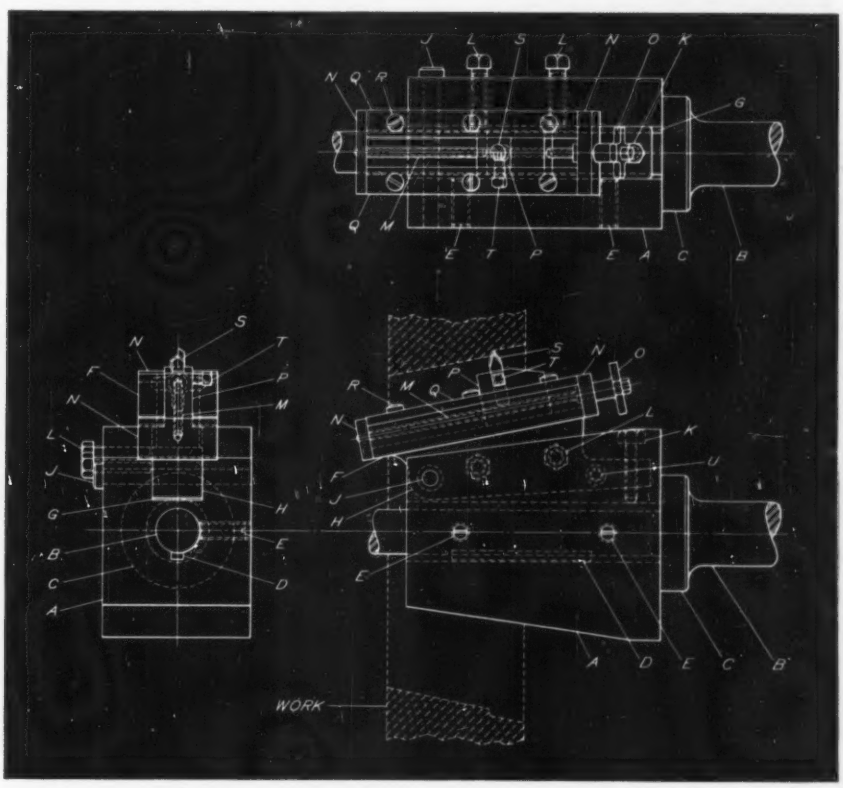
Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Adjustable Taper Boring Attachment

By W. M. HALLIDAY, Birkdale, Southport, England

In the illustration is shown a simple attachment for machining large-diameter open cores in castings to tapers of various side angles. Although the device is intended primarily for horizontal boring mill applications, it is readily adaptable to a vertical boring mill or a conventional lathe having no other provision for producing internal tapers. In principle, a body fixed to and revolving with the regular boring-bar of the machine carries a slide that is adjustable to the required side angle of the taper. Feeding along the slide by means of a star-wheel is a small tool-block containing a single-point cutter.

The body *A*, which is a steel block trapezoidal in shape, fits closely over the boring-bar *B* of the machine, and receives positive endwise location by its bearing against the integral flange *C* of the bar. A key *D* and two set-screws *E* secure the body to the bar. To carry the slide *F*, a slot *G* is milled in the block parallel to the block axis and accommodates a rib *H* extending from the slide. This rib is held in the slot by a dowel-pin *J*, around which the slide can be swiveled to the required angle. Accurate setting is obtained by means of a fine-threaded jack-screw *K* engaged in a tapped hole in the tail-like end of the rib and working against the bottom of the slot. Set-screws *L* in the rear wall of the slot tighten against one side of the rib, locking it in position in the slot.



This taper boring attachment revolves as a unit with the regular boring-bar of the machine, but feeds independently by means of a star-wheel.

In a channel running the length of the slide proper is a fine-pitch lead-screw *M*, free to rotate but restrained from axial movement by shoulders that bear against the two end-plates *N*. Keyed to the right end of the lead-screw is the star-wheel *O*. The tool-block *P* fits the channel and has the cross-section of an inverted "T." Its base is internally threaded to form a nut for the lead-screw. Keeper plates *Q*, which are retained by screws *R*, resist any tendency of the tool-block to rise. For correct cutting action, the hole for the single-point cutter *S* is located in the tool-block so that the cutting edge is on the vertical center line of the machine spindle. A set-screw *T* holds the cutter in position.

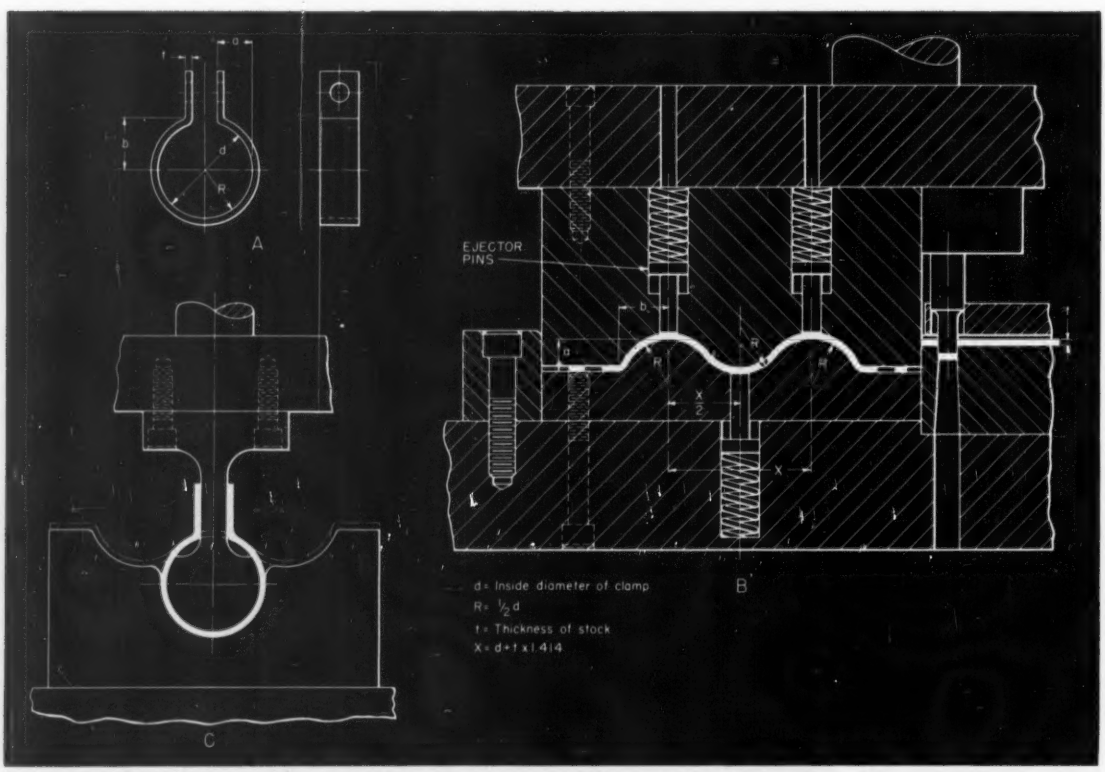
In operation, the tool-block is retracted to the star-wheel end of the slide, and the cutter is set out radially to the diameter of the larger end of the tapered cut. A kicker bar is fastened to the frame or bed of the machine, in position where it will intercept the star-wheel, causing the lead-screw to rotate 90 degrees for each revolution of the spindle.

The length of the slide is determined by the length of the taper; it is practical to design the slide so that it is approximately 25 per cent longer, thus providing sufficient traverse for the tool-block. Where the attachment is to be used intermittently for boring duplicate parts a register pin *U* can be inserted in a reamed hole running through the slot and rib, providing automatic adjustment to the setting. If various angle settings have to be made frequently, spacers of known thickness can be used. A bridge piece is then fastened across the top of the body, straddling the channel immediately above the tail of the rib. By inserting a spacer of predetermined thickness between the bridge piece and the tail, the slide is able to be quickly adjusted and locked at the correct setting.

Designing Dies for Forming Clamps

By Roger Isetts, Kenosha, Wis.

When designing dies for clamps of the type shown at *A* in the accompanying illustration, it is imperative that the first forming operation be correct if a perfectly round finished piece without flat spots is desired. The proper design for the die to be used for the first operation of piercing, cutting off, and forming is shown at *B*. In this die, the distance *X* between the two radii *R* can always be calculated by adding the thickness *t* of the stock to the inside diameter *d* of the finished part and multiplying the sum thus obtained by the constant 1.414.



Dies designed for production of clamp shown at (*A*)

The die employed for the final operation is of quite simple design, consisting of a nest and a punch, as seen at *C*. Dies designed as shown in the views at *B* and *C* allow the part to be formed evenly around the punch of the latter die. The completed piece is picked off the punch on the up stroke of the ram, or it can be blown off toward the back of the press by means of compressed air. No drawing compound is needed.

Finding Vee Angle of Female Jaw for Self-Centering Vise

By A. R. CHASAR, Cleveland, Ohio

A new self-centering vise on a pipe-threading machine features a pair of mating vise jaws, as can be seen in Fig. 1. Both jaws are engaged to a combination left- and right-hand screw, and can grip pipe and tubing ranging in diameter from 1/4 inch to 2 1/2 inches. They replace a pair of symmetrical jaws that had a deep vee on one side and a shallow vee on the other—a design that was necessary for the same range of work, but which often required reversing the jaws on a change-over from one size of pipe to another.

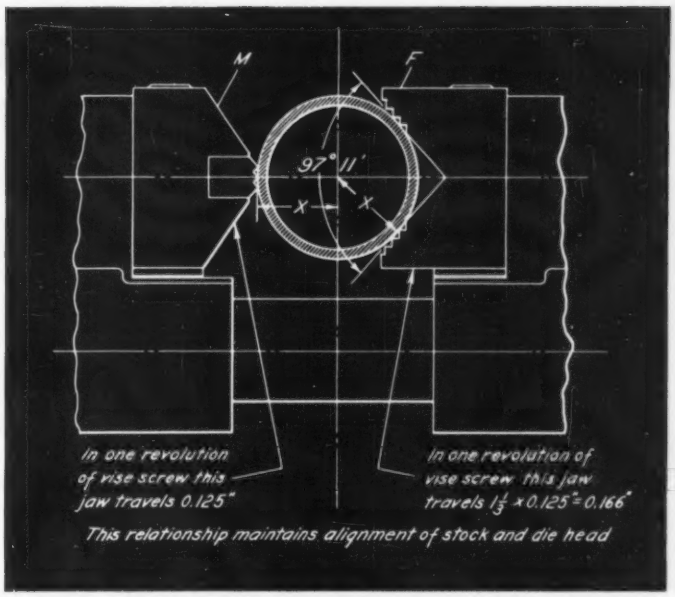

M
F
97° 11'
X
X
In one revolution of vise screw this jaw travels 0.125"
In one revolution of vise screw this jaw travels 1⅓ x 0.125" = 0.166"
This relationship maintains alignment of stock and die head

Fig. 1. With the lead of the jaws in the ratio of 1 1/3 to 1, jaw (F) has an included angle of 97 degrees 11 minutes.

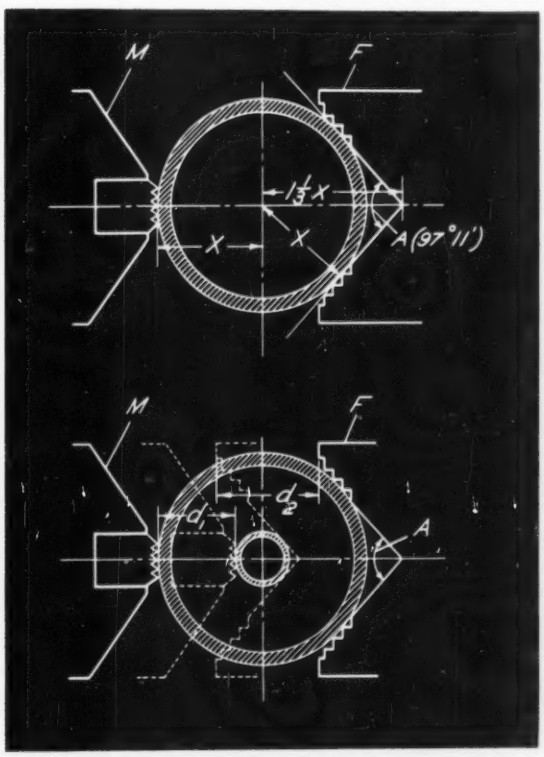


Fig. 2. To center the work, jaw (F) must travel a greater distance than jaw (M).

There is a peculiarity of the new design in centering the work with the pipe die. Although both jaws are engaged to the same screw, the pitch of the screw section for the female jaw *F* must be coarser than that for the male jaw *M*. This point is illustrated in Fig. 2. If, for example, a 1/2-inch pipe is to replace a 2-inch pipe in the vise, jaw *M* moves in the distance d_1, or 0.768 inch (exactly one-half the difference between the outside diameters); but jaw *F* moves in the greater distance d_2.

From an engineering and machining standpoint, it was found practical to specify 8 threads per inch for the male section of the screw, and 6 threads per inch for the female section. Thus, the lead of the female jaw in relation to the male jaw is in the ratio of 1 1/3 to 1. To determine the included, or vee angle *A* of the female jaw so that for the given combination of 8 and 6 threads per inch any diameter of work can be centered with the pipe die, this equation was used:

$$\sin 1/2\ A = \frac{X}{1\ 1/3\ X}$$

Solving for *A*,

$\sin 1/2\ A = 0.75$

$1/2\ A = 48$ degrees 35 minutes 30 seconds

$A = 97$ degrees 11 minutes

Thirty-Seventh Annual Meeting of Gear Manufacturers

PROBABLY the most widely attended convention ever held by the American Gear Manufacturers Association was the thirty-seventh annual meeting at the Homestead, Hot Springs, Va., from May 31 to June 3, inclusive. The general meeting on Monday morning, June 1, was presided over by S. L. Crawshaw, president of the Association.

George H. Sanborn, sales manager of the Fellows Gear Shaper Co., Springfield, Vt., was elected president of the Association for the current year; R. B. Holmes, general manager of the Philadelphia plant of the Link-Belt Co., was elected vice-president; and Fred R. Eberhardt, president of the Eberhardt-Denver Co., Denver, Colo., was elected treasurer.

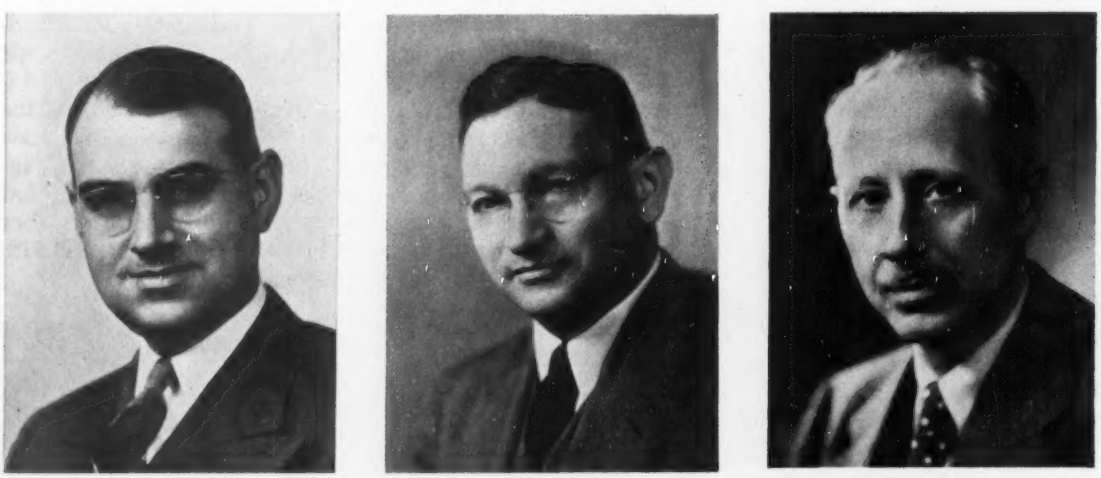
Mr. Sanborn's many AGMA assignments have included the chairmanship of the Operating and Controlling Committee and membership on various other committees. For the past year, he held the office of vice-president. Mr. Holmes has also been active in Association affairs over a long period, having served on several committees prior to being treasurer this past year. Mr. Eberhardt for the last three years was a member of the Executive Committee.

An outstanding paper entitled "Shot Peening in the Design of Gears" was presented by John C. Straub, chief research engineer, the American Wheelabrator & Equipment Corporation, Mishawaka, Ind. Another paper of unusual merit, "The Analytical Approach to Purchasing," was presented by Andrew M. Kennedy, Jr., assistant general manager of purchases, Westinghouse Electric Corporation, Pittsburgh, Pa.

In the introduction to his paper, Mr. Straub pointed out that shot peening is a process which might well be considered in designing any machine part required to carry high loads when minimum size or weight of the complete unit constitutes an important factor. His paper indicated that shot peening can be used effectively not only to eliminate fatigue failures but also to increase the load-carrying capacity per pound of gears and other machine parts.

"A few years ago," said Mr. Straub, "shot peening of a particular machine part may have been looked upon as evidence that the part in question had at some time given trouble in service by reason of fatigue failures. Today shot peening is being considered more and more as a means of increasing the allowable fatigue strength in the design of machine parts. The fact that a part is being peened in production does not necessarily imply that fatigue failures have been experienced on that part in the field."

Mr. Straub's paper discussed the increase in fatigue strength and in bending strength obtained through shot peening; the influence on scoring or pitting; the noise of peened gears; the method of controlling the amount of peening; the choice of shot size; and peening equipment.



(Left to right) George H. Sanborn, newly elected president of the American Gear Manufacturers Association; R. B. Holmes, vice-president; and Fred R. Eberhardt, treasurer

The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Telling My Technical Story

THE ability to give a technical talk in a clear and convincing way is not a common characteristic of engineers. Having recently listened to a number of technical talks, I was struck with the weakness of many an engineer in conveying his wealth of knowledge and experience to his listeners. Too often as the speaker proceeds, the interest and attention of his audience dwindle.

Some of us lose confidence as we face a large group. Nevertheless, whether it be from the platform or across the desk, skill in putting across your message is a distinctive part of equipment selling. One sales engineer recently said, "The longer I'm in the sales engineering game, the more I realize that every time I tell a technical story my prospect compares me with some competitive salesman. The prospect's impression of what I know and what I can do for him depends on the way I relate my message."

By observing both good and bad techniques of platform speakers, we can find ways to strengthen across-the-desk or in-the-shop selling.

1. Let's be sure we correctly size up the interests and knowledge of our listeners. If you have heard Dr. David B. Steinman give an illustrated talk on bridge design, construction, and failure, you will have heard a speaker who knows what would interest his particular group of listeners, and then delivers a speech with simplicity, clarity, and warmth. But how differently this eminent engineer might slant his talk to another group with a specialized interest in bridge design and erection. Tailor the talk, then, to the interests, responsibilities, and technical knowledge of the prospect.

2. Of importance is logical procedure. How many sales engineers make a bad start, or jump irrationally from one point to another, or fail to "button up" with a conclusion. Scattered or misplaced ideas do not take root. We must make it easy for the listener to follow.

3. Homely illustrations can be made very effective in explaining a point. One of the best examples I can recall was employed by a salesman in selling power-factor corrective equipment to plant engineers. He compared the capacity of the electrical system to a glass of foaming beer served over the bar. By the use of his equipment, "You get a full glass of beer, not one loaded with foam." The introduction of a little humor has a wonderful effect in lubricating our message. We can test our own brand of humor and rate it for popularity.

4. Choose carefully such selling tools as diagrams, drawings, and data, and use them intelligently. Most listeners have grown tired at a public meeting of seeing the speaker flash on a screen in rapid succession complicated diagrams and tabulations. "This illustrates how the machine is connected up." Or, "This table shows savings." But for the life of us, without time and orientation, we cannot follow the illustrations. The secret of the effective use of illustrative material is its careful selection as to pertinency, planned simplicity, and clarity of form. A few crystal clear words of explanation with each display can produce the desired conclusion.

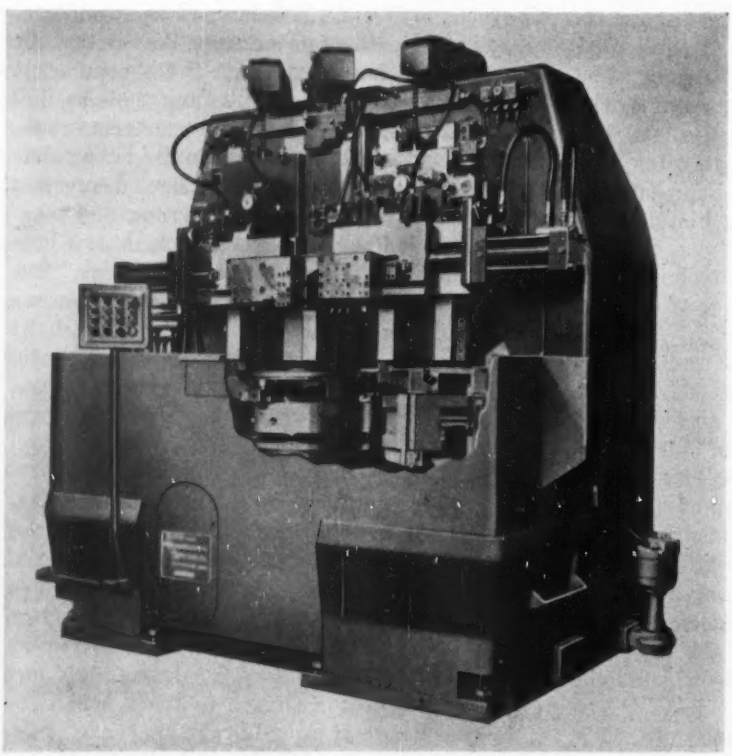
5. Aside from those important qualities of expression and speech, timing and punctuation are decidedly necessary. There's a wide difference in the rate of perception of each listener. "I find so often that I am either ahead of my prospect or trailing behind, and he starts fiddling with papers or looking out the window," a salesman told me. Give the prospect a chance to react, and then adjust your rate of procedure and depth of penetration accordingly. A common fault of sales engineers is that of talking too fast, without regard for the prospect's rate of perception.

LATEST DEVELOPMENTS IN *Shop*

Motch & Merryweather Vertical Turning and Boring Machine for Jet-Engine Parts

A special machine has been developed and built by the Motch & Merryweather Machinery Co., Dept. M, 715 Penton Bldg., Cleveland 13, Ohio, to facilitate the economical production of large compressor wheels for jet engines. This machine utilizes multiple-mounted cutting tools on independent tool-slides for rough- and semi-finish-turning operations. It has a vertical spindle, and is of the automatic cycling type. Extremely rigid construction and the provision of sufficient driving power for heavy cuts are outstanding features of the machine.

In one operation performed by this machine, seven tools engage the work simultaneously at a cutting speed of approximately 225 surface feet per minute and a cutting depth of about 3/8 inch. Machining time for the entire face of a stainless-steel disc 24 inches in diameter is nineteen minutes.



Machine developed by the Motch & Merryweather Machinery Co. for use in the production of jet-engine compressor wheels

The two main vertical slides of the machine are used for the roughing operations. A side-head and a center slide are added for semi-finishing work. Each slide is individually driven and has a feed that is variable through hydraulic control valves. All heads have a completely automatic operating cycle. The center slide performs an under-cutting operation after the semi-finishing work is completed. Micrometer adjustment is provided for each tool-head. The tools are set in blocks that can be readily interchanged on any of the slide units.

A chuck 21 or 24 inches in diameter is used, according to the work being handled. The spindle has an A-15 American Standard nose. The maximum chuck swing is 35 inches, and the maximum work height from the spindle nose is 15 inches. Spindle speeds from 38 to 275 R.P.M. are available in the high-speed range and from 12 1/2 to 92 R.P.M. in the low-speed range. Speed changes are made by means of change-gears. A 60-H.P., 1200-R.P.M. motor is used for the main drive, and a 7 1/2-H.P., 1200-R.P.M. motor for the hydraulic drive of the machine.

Lincoln Shielded-Arc Mild-Steel Electrode

An easily applied, mild-steel E-6010 type electrode, called the "Fleetweld 51," has been placed on the market by the Lincoln Electric Co., Dept. M, Cleveland 17, Ohio. This shielded-arc electrode is designed for all-position welding with direct current. It is suited for welding all types of joints in the overhead or vertical position,

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

and is especially well adapted for "vertical up" welding. It produces flat-faced fillets when used to weld in a vertical position, and reduces sagging or excessive convexity on welds made in any position.

"Fleetweld 51" electrode can be used with excellent results for welding galvanized, dirty, or rusty plate and pipe in all positions with "vertical up" techniques. These electrodes are regularly available in 14-inch lengths and in diameters of 1/8, 5/32, and 3/16 inch.

Giant Gear-Shaving Machine

A gear-shaving machine, believed to be the largest in the world, was recently completed by the National Broach & Machine Co., Dept. M, 5600 St. Jean, Detroit 13, Mich. This machine will handle gears having pitch diameters as large as 180 inches and, with certain modifications, the capacity can be increased to 200 inches. It will shave gears 180 inches in diameter that weigh approximately 30 tons and have from 900 to 1800 teeth, the number of teeth depending on the diametral pitch. When the gear is properly hobbed, the shaving process will reduce errors in the tooth profile within a tolerance of 0.0002 inch and errors in indexing or pitch within 0.0003 inch. The machine also produces teeth having exceptionally smooth surfaces without danger of burning.

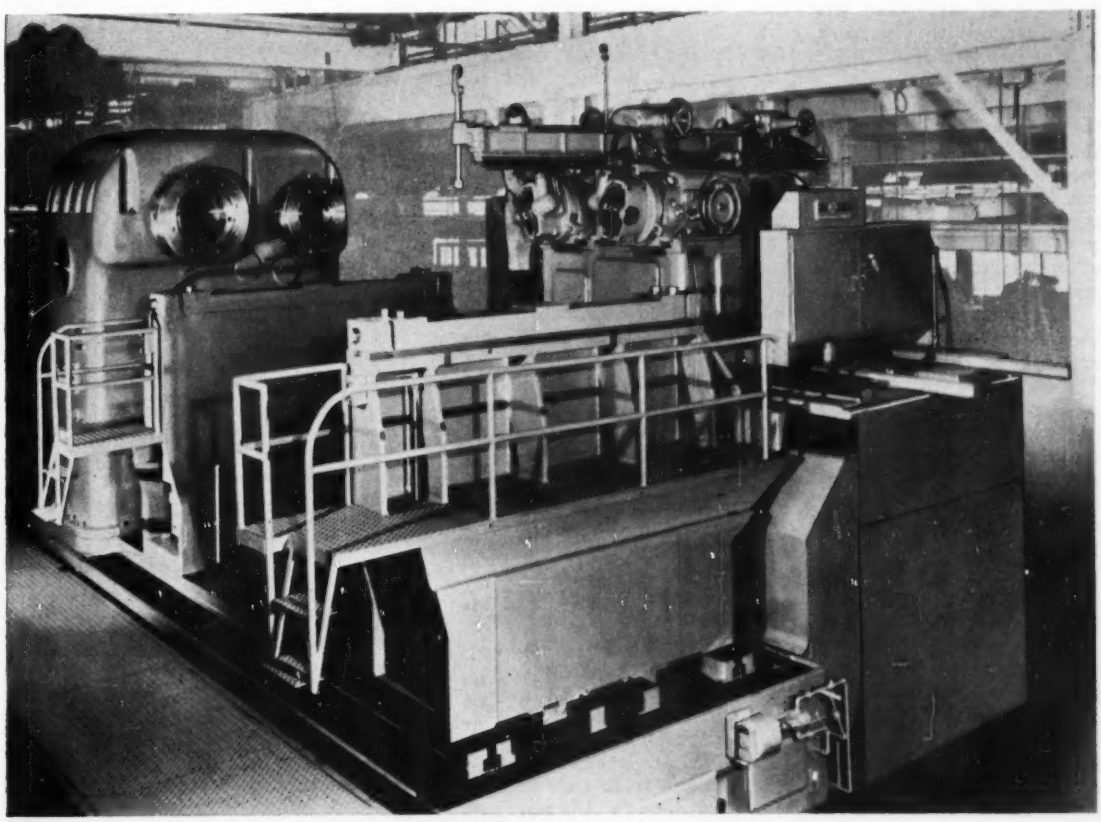


Fig. 1. "Red Ring" gear-shaving machine with dual work-spindles shown at the left, pedestals in the foreground, and saddle assembly with two cutter-heads and journal checker in the rear

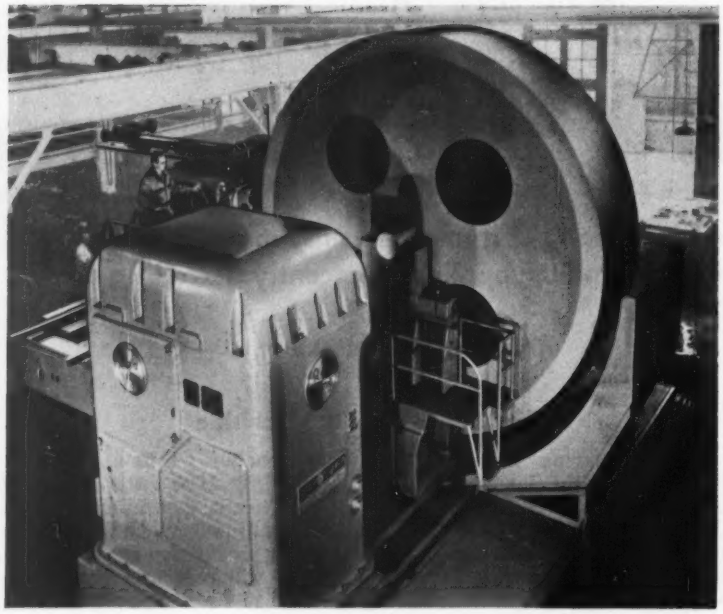


Fig. 2. "Red Ring" shaving machine with dummy gear in shaving position

After the work gear to be shaved is loaded and its shaft aligned, one of the shaving cutters is advanced into mesh with the work gear. With the work gear driving the cutter, the latter moves across the face of the former. At the end of its traverse, the rotation of the work gear is reversed and an increment of infeed is set manually by the operator. The cutter then moves back across the face of the work gear to complete its stroke. At the end of a predetermined number of strokes, the machine is stopped.

Large marine gears can be shaved with their axes in either a vertical or horizontal position. The machine shown in Figs. 1 and 2 is built for horizontal-axis shaving with the work gear rotating in journal bearings in the same manner as when assembled in the reduction unit. This gear-shaving machine weighs approximately 115 tons. It is 24 feet long, 25 feet wide, and, including a large work gear, rises 18.5 feet above its concrete foundation.

Twin journals in each of the work-carrying pedestals and twin spindles in the headstock provide a range for shaving gears having pitch diameters of from 30 to 180 inches. Large marine drive gears of the herringbone type that require two different settings of the cutter-head (one for each side of the herringbone) can be handled to advantage on this machine. With two cutter-heads available, each can be carefully set for its side of the herringbone. Three operational control stations, one on each side of the saddle and one at the headstock, facilitate setting up the machine and controlling the operating cycle.

Power-traverse is provided for the saddle and pedestals. The pedestals have operator platforms and easy adjustments for accurate alignment of the work gear. The base consists of two parts rigidly locked together with spacers. The front part carries the stationary work-drive headstock and two adjustable pedestals. The rear part carries the saddle assembly (including cutter-head slides and journal checker) which may be positioned by power within a 137-inch traverse range.

The work-gear shaft is carried in the journal bearings of the two pedestals, and is driven through a flexible coupling by the headstock spindle. Each pedestal has a front journal bearing for large work gears and a rear bearing for smaller units. Both pedestals can be power-traversed in line with the work-gear axis, and they can also be adjusted at 90 degrees with that axis. When positioned, they are locked in place to the top of the front base and to the forward side of the rear base.

The headstock is also equipped with two spindles. These spindles are spaced 40 inches between centers. The front, or larger, spindle is used for the larger work gears, while the rear spindle accommodates the smaller units. The change-gears that control the spindle speeds are so arranged that when either spindle is operating, the other is inoperative. The headstock carries its own 25-H.P. driving motor located in its base.

The saddle, operating on hardened and ground ways, is a self-contained unit equipped with a two-speed reversing motor. It can be traversed in either direction under push-button control. Pressure lubrication is provided for all important bearings. The operator's platforms on either side of the saddle travel with the saddle, but are insulated from it by springs and rubber bumpers. The weight of the platforms and that of the operator are taken directly by separate roller rails attached to the top of the rear base. The large saddle feed-screw, which is anchored at both ends, remains stationary. The direction of saddle feed relative to headstock spindle rotation can be reversed by means of a selector switch to suit any operating requirements.

The cutter-head assembly includes two cutter-slides and a journal alignment checker between them. Each cutter-slide is provided with power-traverse in order to bring it quickly into approximate shaving position with the work gear. These slides have hardened and ground ways. Both cutter-heads have precision, antifriction bearing spindles. The crossed-axes setting of each cutter-head is made by a sensitive adjustment crank and vernier scale, a dial indicator being used for the final setting.

Anderson Fitted Plastic Covers for Protecting Balancing Ways

The Anderson Bros. Mfg. Co., Dept. M, 1907 Kishwaukee St., Rockford, Ill., is offering fitted plastic covers designed to protect Anderson balancing ways from dust, emery, or other particles that might settle in the bearings. Thus, the covers serve to maintain the sensitivity and accuracy of this equipment. The covers are washable, and are easy to slip on and off the ways. They are available for 20-, 40-, and 60-inch balancing ways.

Instrument for Measuring Radial Play in Ball Bearings

An instrument for measuring the internal radial clearance in ball bearings is announced by the Sheffield Corporation, Dept. M, Dayton 1, Ohio. This instrument is of the pivotal arm type and is designed for easier, faster, and more accurate measuring of the radial play in ball bearings. It is intended for use on the production line and for inspecting finished bearings received or ready for shipment. The instrument can also be used to set up control over radial play before the bearings are assembled with their components. One of the advantages claimed for this instrument is that an inexperienced worker can easily learn to perform the simple four-step measuring operation.

One model is used for ball bearings having outer diameters ranging from 18 to 90 millimeters, while another model accommodates bearings with outside diameters of from 90 to 180 millimeters. The measuring loads on both models can be adjusted to conform to the Standards of the Anti-Friction Bearing Manufacturers Association, Inc., Revision No. 1 of April 1952.

The instrument has two air-operated pivotal load-bearing arms that alternately exert upward and downward pressure on the bearing. At the same time, it measures the successive movements of the outer ring to determine the amount of radial play of the bearing in that position.

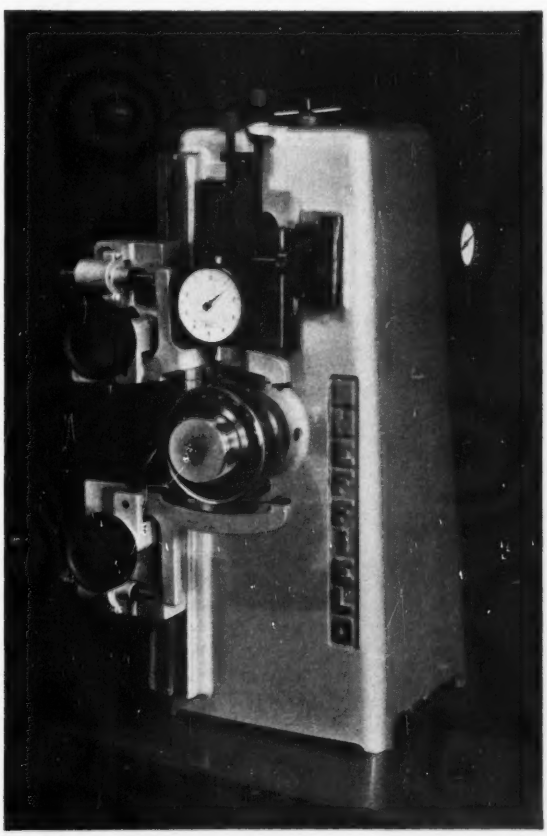
Other features include means for automatically shaking the balls down into the bottom of the groove and a single three-station foot-pedal control for the load-bearing arms. Arbors are provided that correspond to the internal diameters of the inner rings of the bearings. Sheffield's "Guidegage" design feature is utilized to facilitate slipping bearings on and off the arbors.

Greenerd Hydraulic Press

Four-post self-contained hydraulic presses of 50- and 75-ton capacities have now been added to the line manufactured by the Greenerd Arbor Press Co., Dept. M, Nashua, N. H. The small H-54-4 press of cast semisteel construction has a range of 0 to 16 1/2 tons at a ram speed of 92 inches per minute and a capacity of 16 1/2 to 50 tons at a ram speed of 30 inches per minute. This press has a 7 1/2-H.P. 1200-R.P.M. motor.

The larger H-75-4 press of cast hard Mehanite steel has a capacity range of 0 to 25 tons at a ram speed of 92 inches per minute and of 25 to 75 tons at a speed of 30 inches per minute. A 10-H.P., 1200-R.P.M. motor is used in this press. Both presses have a return ram speed of 150 inches per minute.

The cylinder is a separate unit equipped with piston and piston rings. The rapid traverse operates at a pressure of 1000 pounds per



Sheffield radial play measuring instrument

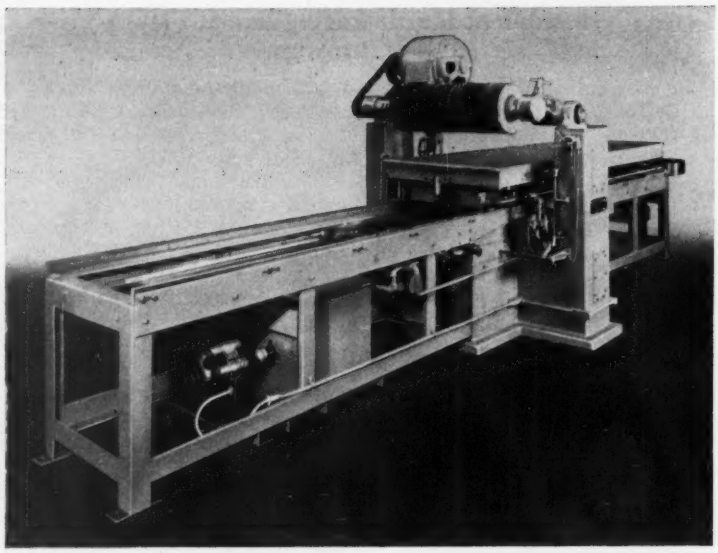
Greenerd self-contained hydraulic press

square inch. A higher pressure obtained by a booster is used for the work speed, thus giving higher tonnage capacity with a low power input. Tie-rods are 3 1/2 inches in diameter, and the clearance between them, from left to right, is 36 inches and, front to back, 25 inches. Daylight capacity is 20 inches. The hardened and ground ram, which is 5 inches in diameter, has a removable ram nose. The ram stroke is adjustable to 12 inches and is hand-controlled. A direct-reading gage registers the tonnage applied. The machined work surface of the table is 36 inches square.

Peerless Improved Hacksaw

The Peerless Machine Co., Dept. M, 1600 Junction Ave., Racine, Wis., recently announced an improved model of its vertical extra heavy-duty hydraulic hacksaw machine. Changes include a larger hydraulic pump, feed piston and piston ring of improved design, and a cam action developed to effect precision timing in bringing the saw in and out of the work.

The feed pressure is applied through a new hydraulic system that gives the vertical saw blade a higher lift on the relief or non-cutting stroke. Coolant applied at the top of the vertical saw blade washes the chips quickly into a tray, permitting the saw blade to cut faster.



Hydraulically operated polishing machine made by Central Machine Works

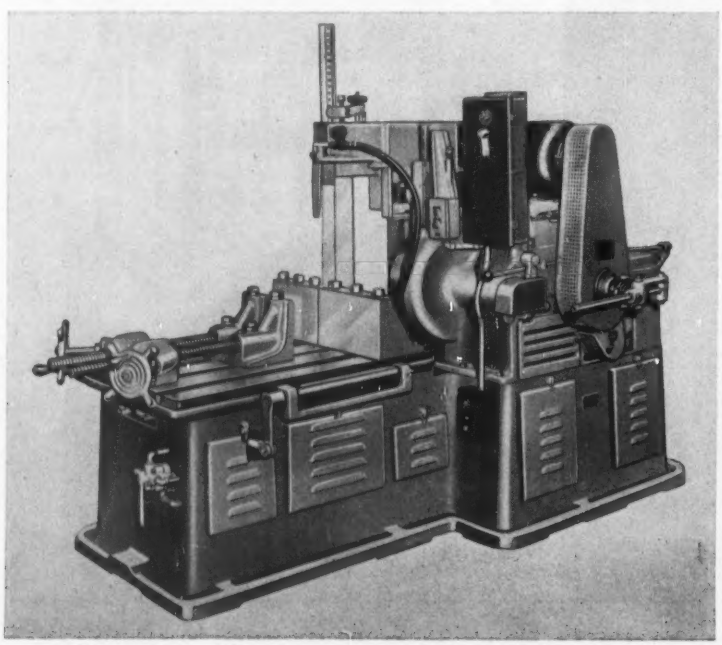
All the slide bearings are provided with hardened and ground removable inserts and replaceable heat-treated shoes. Revolving heavy-load bearings are of the ball or roller bearing anti-friction type; and an air cylinder counterbalances or offsets the weight of the saw frame in its reciprocating motion. The machine is capable of sawing metal at the rate of 10 square inches per minute, depending, of course, on the shape, size, and kind of material that is being cut.

Horizontal, Multi-Purpose Mechanical Polishing Machine

The Central Machine Works, Dept. M, 72 Commercial St., Worcester, Mass., has brought out a new H-M series of horizontal polishing machines which are adapted for polishing extrusions, sheets, and rods, as well as smaller and odd-shaped pieces. They are made in sizes having strokes ranging from 7 to 21 feet, and permit extrusions and sheets to be polished over their entire length.

The hydraulic equipment has provision for obtaining a dwell during the polishing action. It also has means for adjusting the stroke by stepless increments from 2 inches up to the full capacity of the machine. These horizontal machines are equipped with the hydraulic contour device used on the manufacturer's vertical type polishing machines. Contour cams for use on these machines are made of plywood.

Oscillation of the table across the face of the polishing roll during the stroke is controlled by turning a valve. The machines can be equipped with a mechanical polishing-compound applicator or spraying equipment, as required to suit the work to be handled.



Improved heavy-duty hydraulic hacksaw brought out by the Peerless Machine Co.

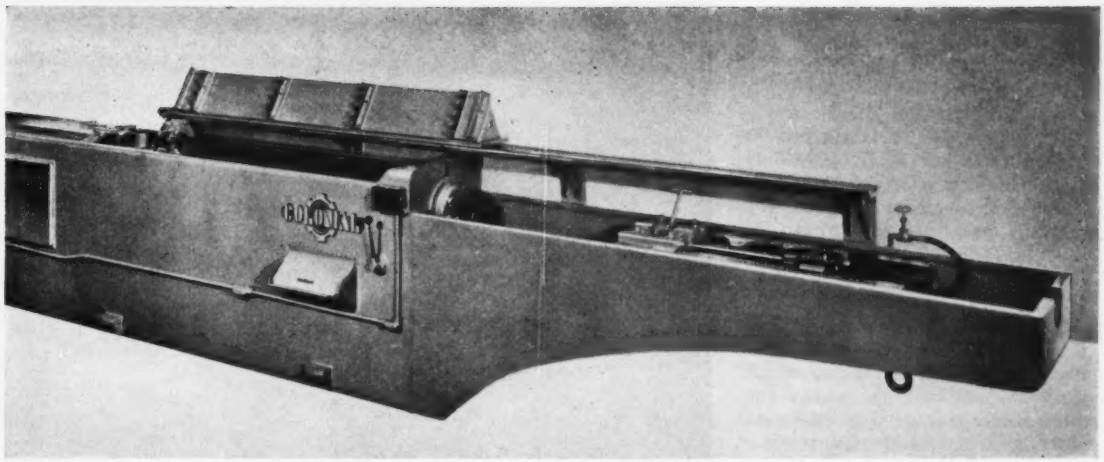


Fig. 1. Traveling carrier for multiple broach handling brought out by the Colonial Broach Co.

Colonial Traveling Broach Racks

The Colonial Broach Co., Dept. M, Box 37, Harper Station, Detroit 13, Mich., recently brought out two types of traveling broach racks to reduce the time required in performing broaching operations. The carrier rack shown in Fig. 1 is designed for application where multiple broaches are used in a predetermined sequence. This carrier rack is attached to and travels with the ram of a horizontal broaching machine. It can be adapted to any standard Colonial horizontal broaching machine.

As the ram moves back and forth, the rack carrying the broaches moves with it. After each broaching pass, the broach is removed and placed in the rack. The ram is returned to the starting position, then the next broach is selected from the rack and inserted in the puller. This arrangement has the advantage of protecting the broaches from damage, since the rack with its padded broach suppports eliminates the need for carrying the broaches to and from stationary racks.

The traveling broach rack with a small crane and hoist shown in Fig. 2 is designed for use on jobs that require the handling of several heavy broaches. This equipment includes a roller-mounted shuttle rack which is connected with the broach ram and is especially adapted for use where two or more passes of heavy broaches are required, and where it is not feasible to remove the part between passes.

When the broaching pass is finished, the rack is automatically located immediately above the broach to be removed. The crane arm is swung into position and padded hooks on the hoist pick up the heavy broach and place it in the rack. The ram then returns to the loading position, followed by the rack. Next the crane swings around, picks up the proper broach from the rack, and lowers it into the broaching position where it is attached to the puller ready for the succeeding pass.

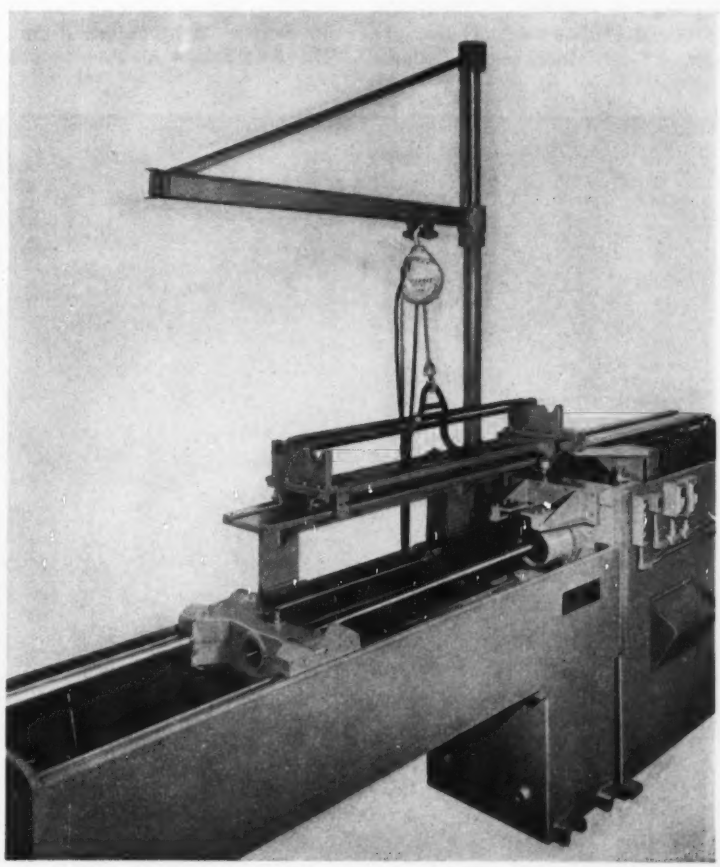


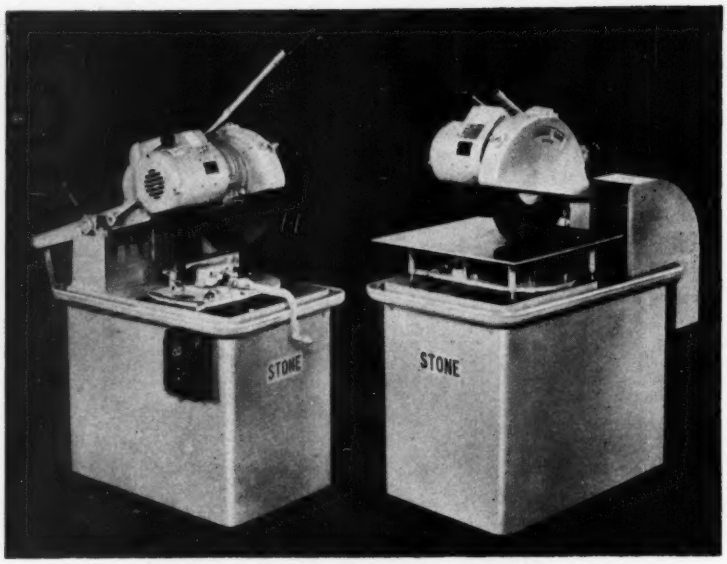
Fig. 2. Traveling broach rack with hoist designed to facilitate handling heavy broaches

Stone Heavy-Duty Cut-Off Machine

A heavy-duty M75 cut-off machine that can be used for regular cutting-off work or converted in five minutes for such operations as freehand cutting of gates and risers from non-ferrous foundry castings, has been brought out by the Stone Machinery Co., Inc., Dept. M, 513 Fayette St., Manlius, N. Y.

The view at the left in the illustration shows the set-up for regular cutting-off work, while the view at the right shows the machine converted for freehand cutting. When used as a regular cut-off machine, abrasive blades are used for cutting ferrous materials and semi-high-speed steel saw blades for non-ferrous materials.

The machine will cut off 2 1/2-inch solid bars and 4-inch pipe, tubing, and structural bars. It is equipped with a 7 1/2-H.P. geared-in-head motor. The direct drive, obtained without the use of belts or pulleys, is designed to deliver full power to the cutting wheel spindle.



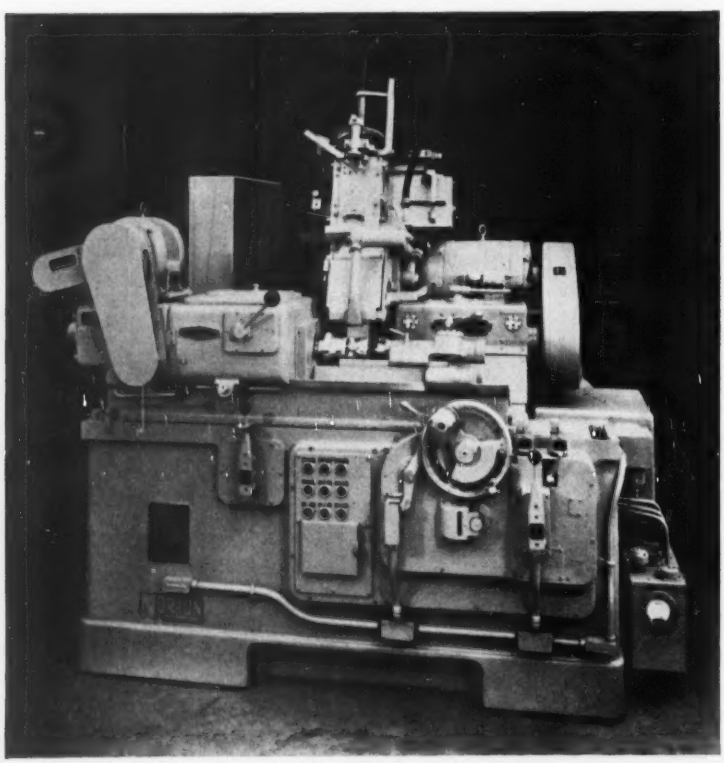
Stone cut-off machine set up for regular cutting-off work (left) and for freehand cutting (right)

Norton Semi-Automatic Piston-Grinding Machine

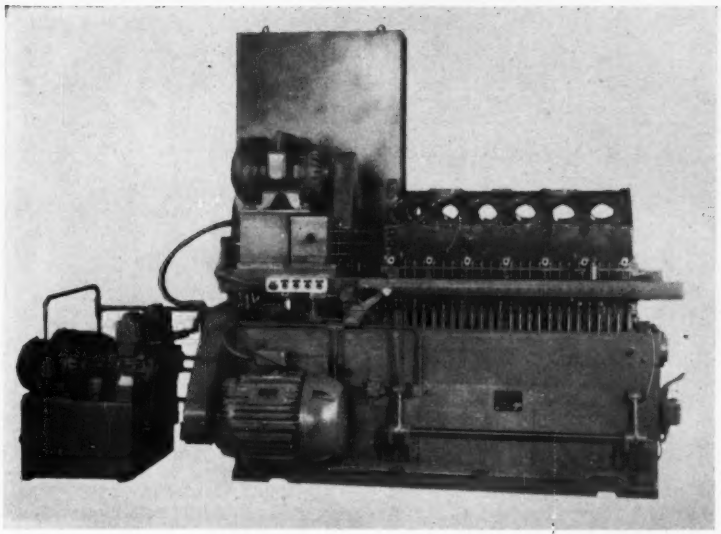
The Norton Co., Dept. M, Worcester 6, Mass., has brought out a 6-by 8-inch semi-automatic piston-grinding machine equipped for delivery as a "packaged unit." The fast action of this machine has been designed to provide the means for the economical grinding of elliptical automotive and aircraft type pistons within close limits of accuracy and with a fine surface finish. The machine can be specially arranged for grinding piston skirts where the degree of relief varies from the top to the bottom of the skirt.

This heavily built plunge type grinder has a wheel-spindle unit and a cam-generating mechanism that gives the work-piece the specific motion necessary for grinding the required skirt form. The hydraulically actuated, revolving feed-screw, wheel-feed mechanism has been developed for fast, precise operation. It provides hydraulic means for rapidly traversing the wheel-head and operating the mechanical micrometer screw feed during grinding.

Little operating effort is required to run the machine, thus allowing the operator to devote the major portion of his attention to loading and unloading the work. For instance, wheel truing is done automatically by a wheel guard type truing device at the touch of a push-button, and the grinding cycle is started by the movement of a single lever. To simplify maintenance functions, all pumps, motors, relief valves, and flow control valves are mounted in accessible locations.



Semi-automatic piston-grinding machine brought out by the Norton Co.



Machine developed by the Moline Tool Co. for back spot-facing crankcases

Moline Special Machine Designed for Back Spot-Facing Crankcases

A fifty-six-spindle machine for back spot-facing two parallel lines of twenty-five holes each in the pan-rail face, as well as six holes in accessory end of an aluminum crankcase for internal combustion engines, has been announced by the Moline Tool Co., Dept. M, Moline, Ill. The table of this machine has hardened and ground rest-plates on which the crankcase is clamped. Accurate positioning of the work is assured by locating pins. The table is lowered by hydraulic power so that the fifty spindles for the back spot-facing cutters extend upward through the previously drilled holes in the pan rail.

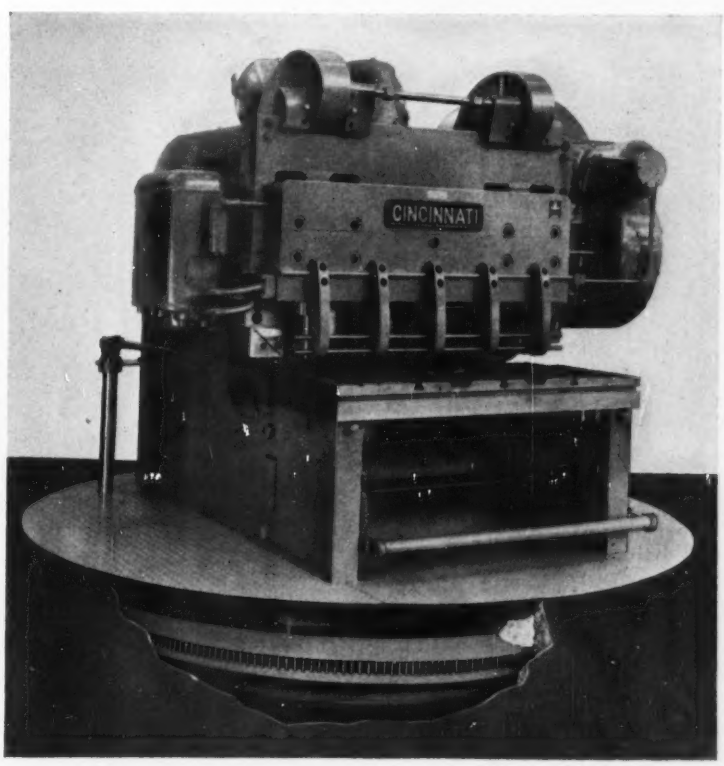
At the same time, the six cutter-spindles for the accessory end of the crankcase are moved into their working positions in which they extend through the holes that are to be back spot-faced. These six spindles are mounted on a separate hydraulically fed unit that moves up and down with the main table. The cutters, each with a bayonet type lock, are placed on the spindles by the operator.

When all the cutters have been properly positioned and the positive stops moved into place, spindle rotation is started by pressing a push-button. The automatic hydraulic feed cycle is then initiated by pushing another control button. The feed cycle includes adjustable dwell periods in which the work is held in contact with the cutters by pressure against positive stops, so that all spot-facing cuts will be finished to the correct depth. Following the dwell, the reverse travel movement returns the work and cutters to the starting position. The cutters are then removed from the spindles prior to their withdrawal and unloading of the crankcase from the fixture.

Cincinnati All-Steel Shear Mounted on Turntable

The Cincinnati Shaper Co., Dept. M, Hopple, Garrard, and Elam Sts., Cincinnati 25, Ohio, has brought out an all-steel shear capable of cutting mild steel up to 1 inch thick and 4 inches long. This shear is mounted on a turntable which is rotated by means of a circular rack and pinion. The table can be set at different positions to facilitate handling large plates and coiled stock. Provision is made for turning the shear to 90 degrees either side of the center position.

The shear weighs 42,000 pounds, and operates at a speed of thirty strokes per minute. A hinged back-gage angle permits cutting plates to longer lengths than provided for by the back gage. Other features include a light beam shearing gage, ball transfers in the table, and air counterbalances on the ram.



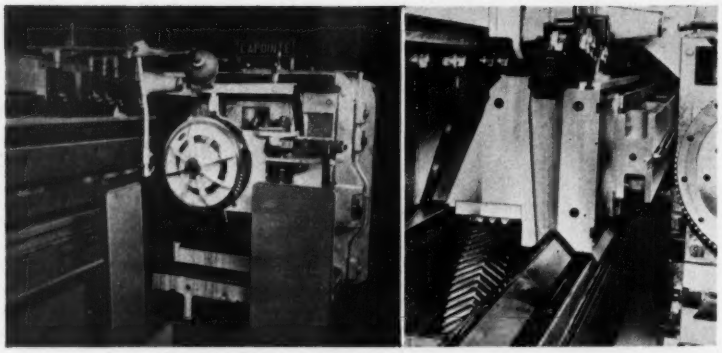
All-steel shear manufactured by the Cincinnati Shaper Co.

"Aeroframe" Profiler and Milling Machine

The Morey Machinery Co., Inc., Dept. M., 410 Broome St., New York 13, N. Y., has brought out an additional model of its 40M "Aeroframe" profiler and milling machine described in November, 1952, MACHINERY. This profiler is designed for the milling and profiling of large forgings and castings, such as aluminum and magnesium airframes, cast-iron parts, and steel forgings.

Important new features are the 10-foot table with full supporting bed and the increased height of 35 inches between the table and cutter-spindle. The machine combines rigidity of construction with the ability to take full advantage of tungsten-carbide tools. It is equipped with a two-speed 15-H.P. motor, operating through a back-geared drive to provide spindle speeds ranging from 125 to 4600 R. P. M.

Included in the construction of this machine are a cross-head mounted on a vibration-dampened cross-rail and a heavier bridge column. The machine can be fitted with a hydraulic following attachment, and is designed to permit operation by unskilled workers.



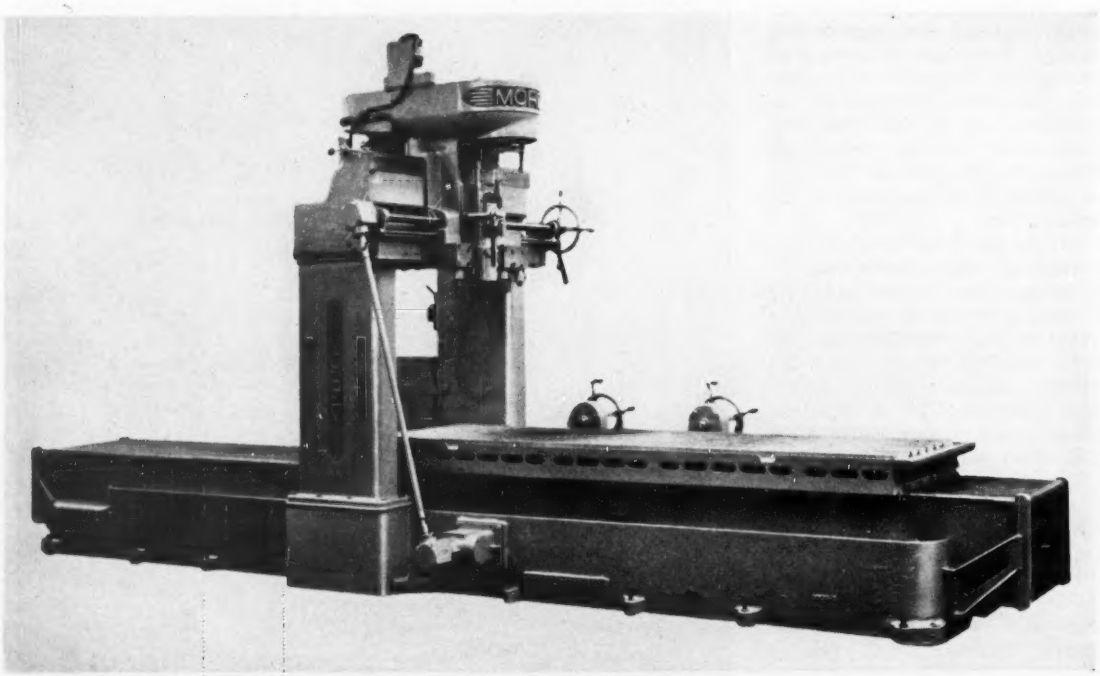
(Left) Lapointe high-speed broaching machine with electro-mechanical drive (Right) View showing main slide and herringbone driving gear of machine

Lapointe High-Speed Broaching Machine

The Lapointe Machine Tool Co., Dept. M, Hudson, Mass., is building a horizontal broaching machine of radically new design in which an electro-mechanical drive is incorporated. This machine can be operated at broaching speeds up to 300 feet per minute. These speeds are said to produce a better finish on the work, provide greater accuracy through freer cutting action, and give increased production. Broaches with carbide teeth can be used at these high speeds, thus permitting many parts to be machined economically now by broaching.

Optional features are "dual speed" and "dual cycle" operation. The dual speed feature permits the machine to be operated at two or more predetermined speeds for the same broaching stroke. Dual cycle is a Lapointe development that has been designed for the successful broaching of jet-engine components without requiring tool change-overs to obtain the accuracy required. Limit switches provided for operating the dual speed and dual cycle equipment can be seen in the view to the left in the illustration.

The view to the right shows the



Profiler and milling machine brought out primarily for the airplane industry by the Morey Machinery Co., Inc.

large main driving gear. This herringbone type gear drives the massive slide, which rides on phenolic ways. The main slide is adjustable, guided and supported throughout the entire stroke on the three-point slide ways. Two slide widths are offered, 16- and 24-inch, with strokes up to 180 inches. Drives up to 200 H.P. can be provided, depending on the speed desired and the amount of material that must be removed from the piece being broached.

The simplified electric controls provide flexibility for setting-up purposes, and have a locking attachment to prevent damage to the machine, tools, or operator when the automatic cycle is used. Operator safety was a chief consideration in designing this high-speed broaching machine. Cutters are located at eye level and can easily be examined at any time. Maintenance is simplified because everything is accessible, and the machine is fitted for a hoist attachment. Two types of worktables are available for this machine—the "in-and-out" table or the Lapointe "tip-down" table.

Keller Power Hacksaw with Quick-Acting Swivel Base

A Keller No. 4 "Hy-Duty" Power hacksaw that has a capacity for cutting stock up to 7 by 7 inches has been announced by the Sales Service Machine Tool Co., Dept. M, 2363 University Ave., St. Paul 14, Minn. The quick-acting swivel-base vise of this machine can be set at an angle of 45 degrees. When set at this angle, bars up to 4 by 7 inches can be cut off. A variable power pressure regulator provides blade pressures from 0 to 200 pounds. This feature increases the efficiency of the saw for cutting materials from light tubing to heavy shafting. An adjustable foot lift helps hold the saw frame in position while the operator is loading or unloading the work.

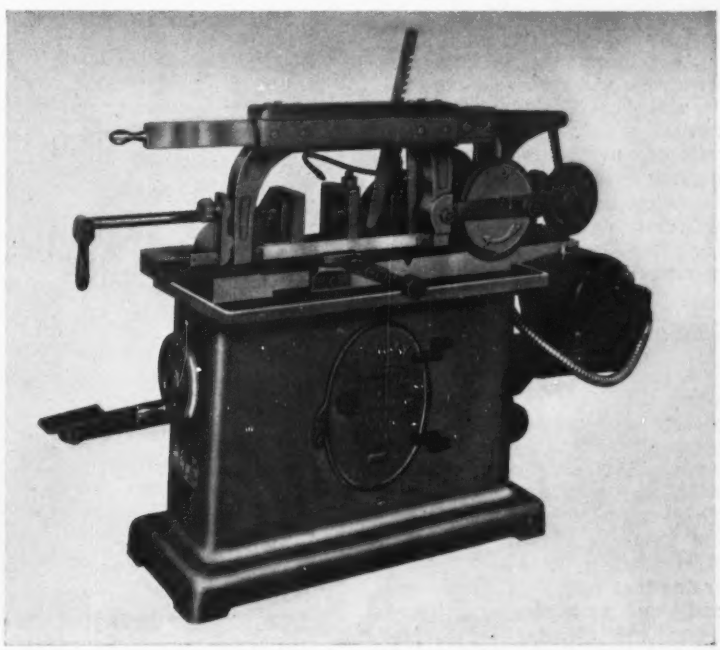
The hacksaw has an automatic lift on the reverse stroke, adjustable bronze bearings for the guide bar in the saw frame, and built-in coolant tank and pump; and is equipped with Oilite bearings. Two speeds—80 and 140 strokes per minute—are available by shifting belts. This model requires a floor space of 17 by 51 inches.

Machine built by The Cross Company for drilling and milling connecting-rods

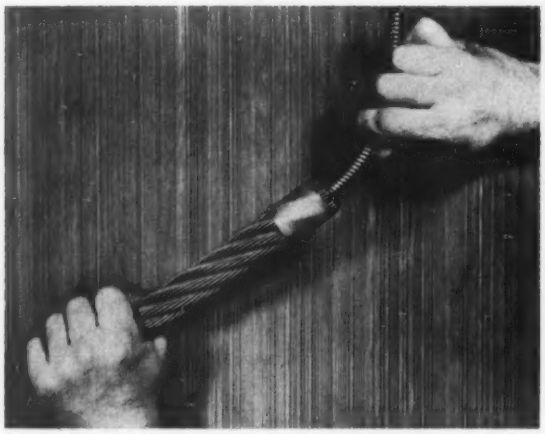
Special Machine for Drilling and Milling Connecting-Rods

A special machine capable of drilling and milling 600 automotive connecting-rods per hour has been announced by The Cross Company, Dept. M, Detroit 7, Mich. This machine has five stations, one for loading, one for milling the lock slot, and three for drilling the stepped oil-hole. The parts are held in hydraulically operated fixtures mounted on an indexing table driven by a fluid type motor.

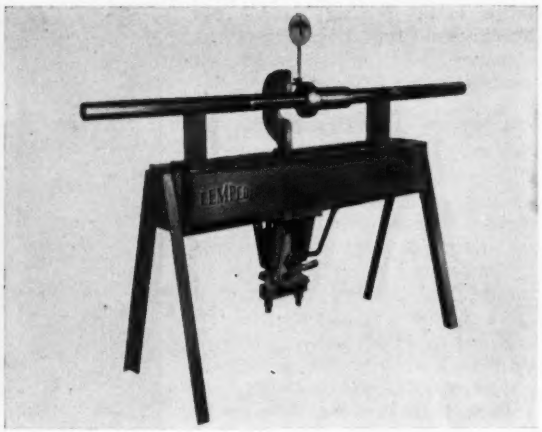
Pre-set cutting tools are used to reduce "down" time and minimize scrap loss. Other features include hardened and ground ways, hydraulic feed, and rapid traverse movements.



Power hacksaw marketed by Sales Service Machine Tool Co.



Wire rope with spring center brought out by the Jones & Laughlin Steel Corporation



Straightening press equipped with dial indicator introduced by Lempco Products, Inc.

Spring-Center Wire Rope

The application of a new principle in wire rope construction was announced recently by the Jones & Laughlin Steel Corporation, Dept. M, Gateway Center, Pittsburgh 30, Pa. The principle is based on the ability of a coiled spring to flex and resist crushing. A wire rope with a core that consists of a coiled steel spring, as shown in the illustration, is a practical application of this principle. This wire rope also has the advantage of holding within the coiled spring center a large amount of lubricant, which serves to keep the rope in good operating condition and enables it to better resist wear and corrosion.

At present, the spring-center wire rope will be carried in 7/8-, 1-, and 1 1/4-inch sizes. Spring centers can, however, be used in wire ropes as small as 3/8 inch in diameter and as large as 2 inches in diameter. It is believed that this new rope will solve one of the troublesome problems encountered in deep-well drilling.

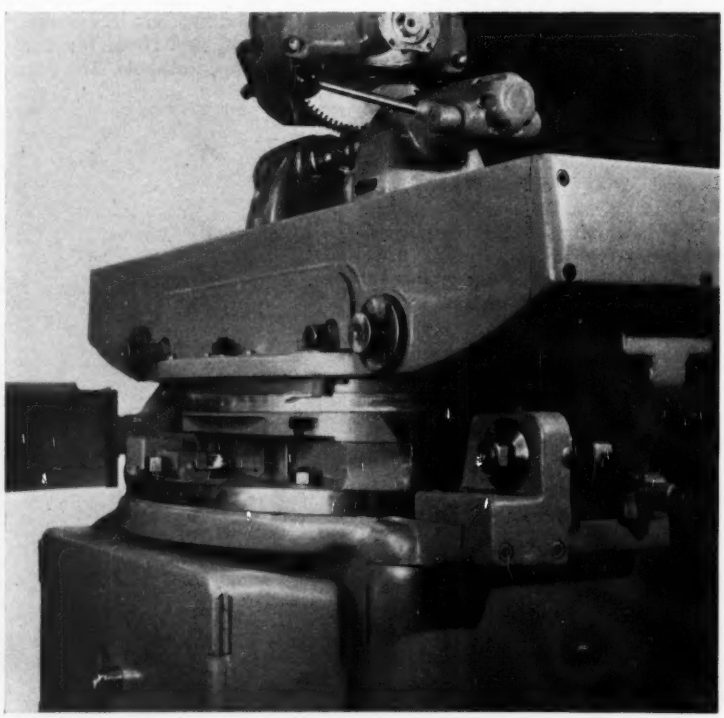
Lempco Straightening Press

A press designed for straightening long shafts, bars, workpieces, and machine parts has been placed on the market by Lempco Products, Inc., Industrial Division, Dept. M, Bedford, Ohio. This low-cost press is intended for use in shops that do their own straightening work. It has a frame that resembles a sawhorse, and an underslung hydraulic pump and cylinder is fastened to the shaft to be straightened by an open-throat clamp.

Pressure is exerted on the shaft at one or more points along its length until the dial indicator mounted on the frame shows identical readings at each point. The V-blocks and the hydraulic pump can be moved along the bed, making it possible to straighten, with a minimum amount of handling, shafts measuring only 1 foot in length as well as shafts up to 10 feet in length. The press illustrated has a bed 65 inches long.

Shaving Machine Equipped for Gear Tooth Crowning

Gear tooth crowning by the conventional method of rocking the machine table during the shaving cycle can now be accomplished on the "Red Ring" Model GCU shaving machine built by



"Red Ring" diagonal shaving machine equipped with cam arrangement for crowning gear teeth, using standard rotary cutter

the National Broach & Machine Co., Dept. M, 5600 St. Jean Ave., Detroit 13, Mich. Heretofore, the crowning of gear teeth on this machine required the use of a specially formed cutter. With the redesigned machine, crowning can be done with any standard rotary cutter while the work gear is being reciprocated in line with its axis.

The rocking action of the table is obtained by means of a control pivot and a cam which causes each end of the table to rise slightly as it is approached by the cutter. The table has been made more rigid, and the crowning cam is located on the table center line to avoid any tendency of the table to twist.

The point of maximum crown, although usually at the center of the tooth, may be shifted either way by changing the position of the work gear with reference to that of the cutter. The amount of crown is a function of the cam adjustment. When it is desired to shave spur or helical gear teeth without a crown, the table remains horizontal throughout its stroke by disengagement of the crowning cam.

Also, gear teeth can be shaved to a predetermined taper by setting the table at the desired angle and locking. Shaving then proceeds on the conventional cycle. The differential up-feed mechanism described in February MACHINERY, page 207, can also be incorporated in this machine.

Line of Fixed and Variable Voltage Rectifier Units

A line of unit rectifiers covering a range of capacities from 3 to 50 K.W., has been announced by the American Rectifier Corporation, Dept. M, 95 Lafayette St., New York City. These rectifiers are designed to convert alternating to direct current at the flick of a switch and to give trouble-free operation. Units now in stock range from 3 to 50 K. W., 125 or 230 volts direct-current output, and either fixed or variable voltage direct-current units to accommodate any alternating-current voltage or frequency input. Also available are units built for standard input voltages at 60 cycles. All rectifiers are tested with a 200 per cent overload to insure dependability under exacting operating conditions.

Dual-Head Automatic Cycle Grinders

Versatility is an outstanding feature claimed for a new line of "Rotamatic" grinders produced by the Standard Electrical Tool Co., Dept. M, 2500 River Road, Cincinnati 4, Ohio. Predetermined angular movements, special work-holders, and rotary magnetic chucks facilitate application to a wide variety of work.

The two grinder heads are operated by hydraulically controlled air cylinders. The machine can also be furnished for hydraulic operation. Provision is made for easy access to all equipment inside the base, including the belted motor drive with mechanical brake solenoids, valves, the motor-driven coolant pump with reservoir, and when required, accessories for magnetic chuck with brush ring and rectifier.

A removable wheel dresser with an air-powered ram can be positioned on the work-holder to permit dressing the two wheels simultaneously. Lateral micrometer adjustment is provided for each grinder head to compensate for wheel wear and for use when dressing the wheels.

Rectifier for converting alternating to direct current made by American Rectifier Corporation

"Rotamatic" grinder placed on the market by the Standard Electrical Tool Co.

Taper-turning attachment made by Associated Engineers, Inc.

Dow Taper-Turning Attachment for Turret Lathes

An attachment developed to increase the taper-turning capacity of standard turret lathes, using the combined feeds of the hexagonal turret and cross-slide, has been announced by Associated Engineers, Inc., Dept. M, Box 1628, Springfield 1, Mass. This Dow attachment consists of two units, the first of which is a roller bracket mounted in the square tool turret or on the cross-slide. The second is an adjustable cam, mounted on a holder which is fitted to the standard hexagonal turret and so located as to allow the cam to contact the roller in the tool turret.

After selecting the cross-slide and hexagonal turret feeds that will most nearly produce the desired angle, the cam is adjusted to compensate for the difference between the angle the machine can produce and that to be cut. As the two feeds are engaged simultaneously with the cam in contact with the roller, a rolling action results. This changes the lateral movement of the tool while the cross-slide travel remains constant, thus increasing or decreasing the angle between the axis of the work and the path of the tool, depending on which direction the cam is rotated. Angular surfaces can be machined internally or externally on either the periphery or face of the work-piece.

Leader Automatic Welding Machine

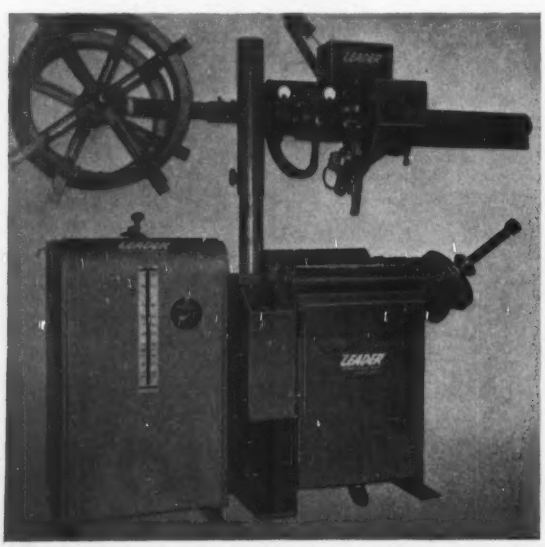
Useful features have been added to the Model 550 automatic welding machine made by the Leader Welding & Mfg. Co., Dept. M, 2418 Sixth St., Berkeley 2, Calif. Among them are an automatic self-adjusting high-frequency arc starter and stabilizer device with no moving parts, which permits the use of low-density current, and a reversible, variable-speed drive control for the work-handling motor.

An Acme-thread, powered arm lift makes arc positioning quick and almost effortless. New flux-handling equipment consists of a sight-feed flux hopper and an adjustable flux bin which can be used with either rollers or a positioner. Standard equipment includes a step-over control for positive, manual operation; 4-inch transverse adjustment that permits exact positioning of electrode wire in relation to the center line for all work diameters; and double reels for handling all types of wire.

Kelite Automatic Steam Cleaner

Automatic firing is the major development in a newly designed high-volume steam cleaner now being manufactured by Kelite Products, Inc., Dept. M, 1250 N. Main St., Los Angeles 12, Calif. Turning on two electric control switches places the machine in operation. One switch controls a specially designed automotive piston type pump, while the second ignites the Kelite automatic oil burner. The burner uses a wide range of fuels, from gasoline to No. 2 Diesel fuel, without changing orifices or burner parts. Another feature that saves fuel consists of trapping radiated burner heat to raise the water temperature 50 degrees before it enters the heating coil. Other automatic controls safeguard the cleaner by turning off the burner if the water supply fails, and preventing the burner from being fired unless the pump is operating.

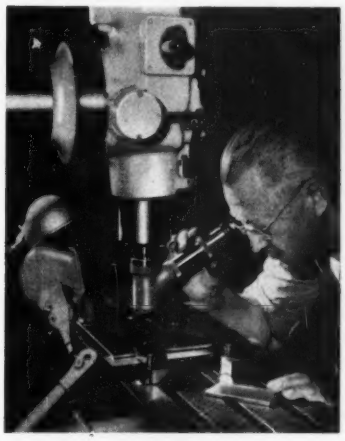
This model K15-A cleaner has a



Leader automatic welding machine

Kelite automatic steam cleaner

capacity of 150 gallons per hour. It is approximately 55 inches long, 27 inches wide, 48 inches high, and weighs 825 pounds. It is delivered with 25 feet of alkali-protected steam hose, a steam gun which permits working without gloves, and a heavy-duty nozzle. When the fuel and solution tanks are filled, the machine can be operated continuously for eight hours without refilling.



Perkin-Elmer locating microscope applied to machine tool spindle

Perkin-Elmer Machine Tool Microscope

A Model 11 machine tool locating microscope having a magnification of 30X, which is said to permit seeing variations in size as fine as 0.0001 inch, is now in production by the Perkin-Elmer Corporation, Dept. M, Norwalk, Conn. When attached to a machine tool such as a jig borer or a vertical milling machine, this instrument aids in checking contours, slots, and surface conditions which cannot accurately be checked by mechanical measuring instruments. It is especially suited for work where holes are too small and contours too irregular to permit the use of an indicator.

The microscope is mounted directly in the machine spindle or on an offset bracket, and can be adapted to nearly any machine tool. A roof prism is incorporated in the optical system to erect the image. Thus, all table movements made by the operator appear to be in the true direction when observed through the eye-piece. The field of vision includes a full 1/4-inch of the work-piece. In precision grinding or boring, the microscope can be used to check the rotational trueness of the part to be ground or bored before the operation starts.

Lehigh "Pro-Tracer" Duplicating Attachment for Engine Lathes

A profile tracing attachment that is adaptable to a wide range of form-turning operations on small-lot jobs is being manufactured by the Air Control Division of Lehigh Foundries, Inc., Dept. M, 1500 Lehigh Drive, Easton, Pa. The Model EL-1100 attachment illustrated is designed for lathes handling work up to 13 inches in diameter. Full use of both cross-feed and compound rest is permitted at all times.

Accurately ground 1/8-by-2-inch wide gage stock templates are recommended to guide the movement of the tracer slide. Boring and turning internal contours can be done by the same method used for conventional external turning. The "Pro-Tracer" can be used effectively for all types of external turning, including tapers, and radius turning of any size above the minimum of 0.031 inch. Turning 90-degree shoulders in the direction of the feed, or blending a shoulder with a radius is possible on either internal or external turning work.

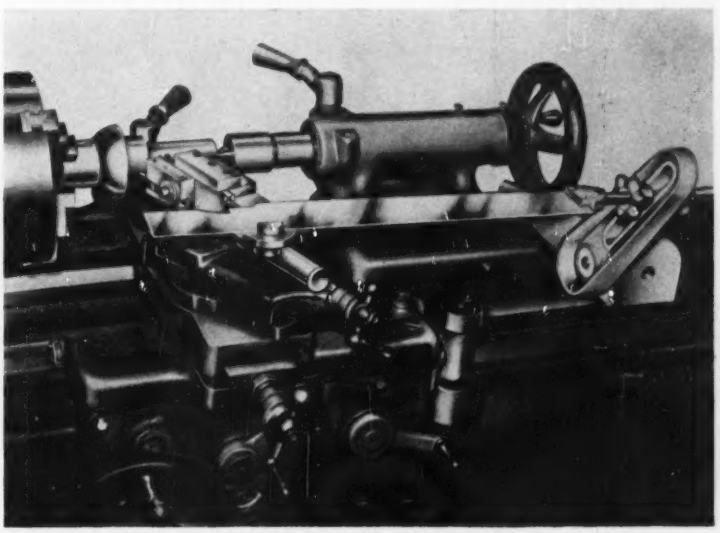
Profile facing is accomplished by turning the tracer attachment at right angles to the lathe spindle. Internal or external threading, either straight or tapered, can be done close to a shoulder without danger of breaking the tools.

Drill press equipped with a tapping attachment brought out by the Commander Mfg. Co.

"Lead-Matic" Tapping Attachment

An automatic lead-screw tapping attachment with a capacity for high-production tapping of holes from No. 0 size to 3/4 inch in diameter, and which fits any drill press, has recently been introduced by the Commander Mfg. Co., Dept. M, 4225 W. Kinzie St., Chicago 24, Ill. Simple electrical controls, located on the face of this "Lead-Matic" tapper unit, permit quick selection of either jog or cycle tapping action—which ever is best suited to the particular operation.

The tapper has a precision-ground lead-screw which pilots



Lehigh "Pro-Tracer" duplicating attachment for lathes

the tap into the work. The lead-screw is designed to insure a high degree of accuracy both with respect to concentricity and the tapping lead, while the drill press merely provides rotation. Consequently, any inaccuracies of the drill press are not reflected in the performance of the tapper. Easily interchangeable, hardened and ground lead-screws and bronze nuts are available for the entire tapping range of this drill press attachment.

Losenhausen Fatigue-Testing Machines

Fatigue-testing machines built by Losenhausenwerk A. G., Germany, for the rapid, accurate testing of large aircraft components, are being introduced in this country by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y. These machines provide means for making tensile, compressive, and bending tests under static, fluctuating, and alternating dynamic loads. The largest standard size machine in this line will apply loads of 200 tons for static testing and 100 tons for dynamic testing.

An outstanding feature of these machines is a pulsator developed for the hydraulic production of pulsating forces at any one of four frequencies. This pulsator can also be attached to the manufacturer's static testing machines to adapt them for dynamic testing under fluctuating loads. In addition, the pulsator can be used with specially designed individual testing cylinders for static and dynamic loading of airplane wings and other large structures.

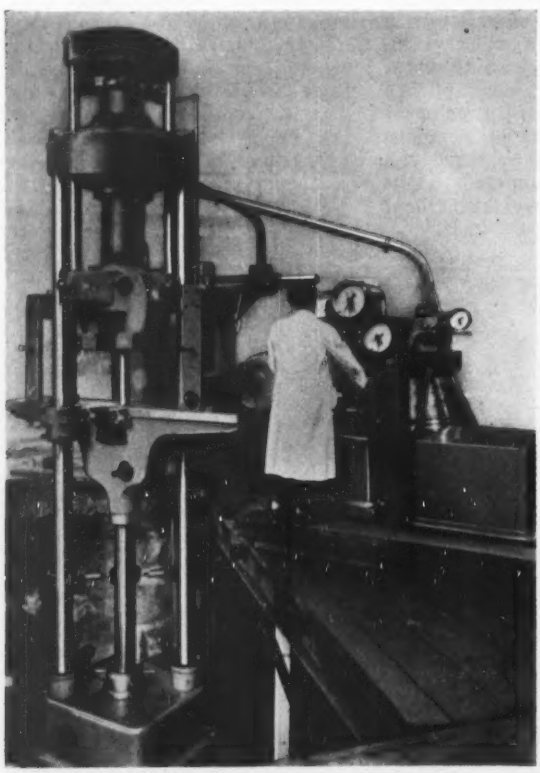
Patternmaker's Milling Machine

A Bokoe Model 2 patternmaker's milling machine, which has an unusually large work-table and a deep throat adapted for machining many sizes and shapes of ferrous, non-ferrous, and wood work-pieces, is being distributed in this country by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y. Manual controls on the work-table provide for a transverse movement of 28 inches and a longitudinal movement of 48 inches. The automatic longitudinal feeding movement of the table is infinitely variable from 3 to 58 inches. The transverse and rotary movements also have automatic feeds. Work up to a diameter of 8 feet 6 inches can be handled on the turntable.

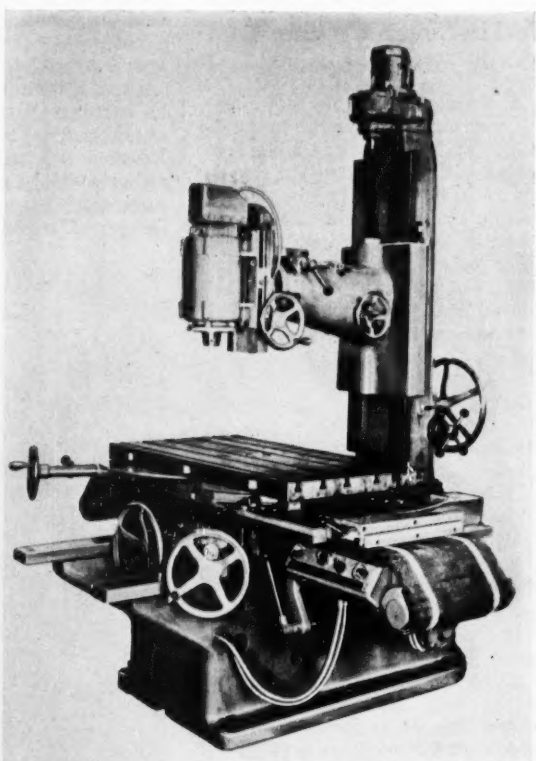
This machine can also be used as a radial drill. By turning the swivel column 180 degrees, it is possible to drill castings mounted on floor skids. The work-table can be swiveled for performing circular work. Accessories are available for adapting the machines to many special requirements.

Bryant Groove Gage

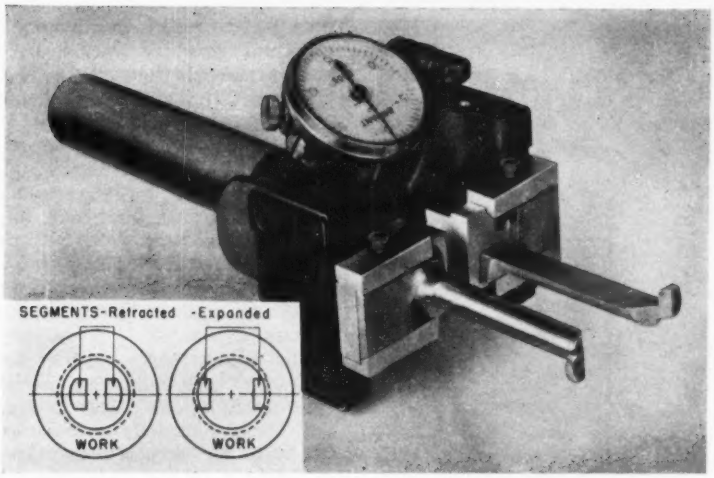
The Bryant Chucking Grinder Co., Dept. M, Springfield, Vt., has brought out an adjustable portable gage for checking the diameter and roundness of internal grooves. This gage covers a range of groove diameters up to 5 inches, and will check grooves which are located at any depth up to 1 or 2 inches from a face, depending on the diameter of the groove.



Machine for testing large aircraft parts introduced by the Kurt Orban Co.



Bokoe patternmaker's milling machine available from the Kurt Orban Co.



Gage for checking diameter and roundness of internal grooves brought out by the Bryant Chucking Grinder Co.

Actual checking of the groove is done by a pair of segments mounted on platforms, one of which is movable. A thumb-lever collapses the movable, spring-loaded segment so that the gaging members may enter the work. Releasing the lever permits the segment caps to expand into the groove. The movable segment actuates a precision dial indicator, which shows any variation from the basic size. An indication of the roundness of the groove is obtained if the work part is rotated on the gage segments, or if the gage is rotated in the work.

The segments are made of cast Stellite to provide rigidity and insure long life. They are held firmly in place by a dovetail clamp. These segments may be adjusted to cover a range of groove diameters by simply loosening the clamp and spacing them to suit the required diameter. This setting may be checked with a micrometer, master setting ring, or gage-blocks.

Four pairs of groove segments will cover standard O-ring grooves from 7/16 inch to 4 7/8 inches in diameter. Four different pairs of segments cover standard snap-ring grooves from 1/4 inch to 5 1/4 inches in diameter. The thickness of the segment cap is made a few thousandths less than the minimum width of the groove in each diameter range, thus insuring that the cap will enter the groove if it is machined within standard tolerance limits.

The minimum width dimension of the standard groove is the limiting factor on the range of a single pair of segments. Actually, one pair of segments may be adjusted over a 2-inch range, thus extending their application to many non-standard grooves.

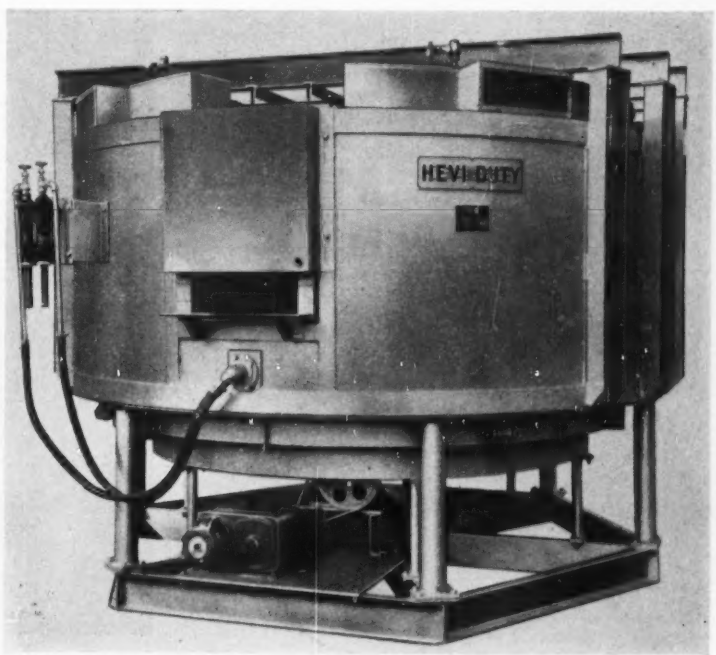
Because this gage gives a direct reading of the variation of a groove diameter from the basic size, it is particularly well adapted for controlling the process at the machine. It is equally useful at the inspection bench for checking internal grooves. The gage is simple to operate and weighs only 18 ounces.

Electric Furnace for Heating Jet-Engine Forgings

Exact temperature and atmosphere controls are features of an electric rotary-hearth furnace recently built by the Hevi Duty Electric Co., Dept. M, Milwaukee 1, Wis. This furnace is designed to operate continuously at temperatures up to 2500 degrees F. The furnace has a rating of 260 kilowatts and a capacity for heating 1500 pounds of forgings per hour. It was designed especially for heating jet-engine parts for forging, but can also be employed for scale-free hardening.

The vertically arranged silicon carbide rod type heating elements can easily be replaced even while the furnace is hot. A protective atmosphere is used for bright surface hardening and to prevent decarburization of special high-temperature alloys. A variable-speed drive mechanism can be adjusted to give the rotating hearth the speed required to meet production needs.

Continuous operation is obtained by placing the cold parts on the slowly rotating hearth and removing the heated ones as they reach the door opening. The door is 18 inches wide and its height is adjustable from 6 to 10 inches. A water-cooled face over the chamber opening protects the operator.



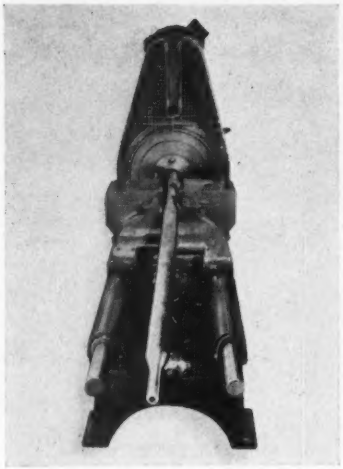
Hevi Duty rotary-hearth furnace designed to heat jet-engine forgings

Rodgers Triple-Duty Open-Yoke Press

Rodgers Hydraulic, Inc., Dept. M, 7450 Walker St., St. Louis Park, Minneapolis 16, Minn., recently introduced a new open-yoke press that is said to perform the work of three separate presses. It incorporates all of the features of standard shop presses; can handle practically every job done on regular forcing presses; and, because of a fully machined yoke bed, can also be used as a regular platen press.

The press is available in 100-, 200-, 300-, and 400-ton capacities. Rugged, machined V-blocks are accurately centered in the yoke member groove. A wear collar is supplied for insertion in the yoke recess, and a bedplate insert is provided to cover the recess and give a continuous flat working surface. The yoke recess takes yoke adapters regularly used with Rodgers forcing presses.

Other features include a movable cylinder with a locking device to provide full pressure across the entire width of the press, clear open ends to permit entrance of long material, a hand-operated winch to raise or lower the bolster, and either hand-operated or power-driven hydraulic pumping equipment.



End view of cold-pointing machine marketed by the Abbey Etna Co.

Cold-Pointing Machine

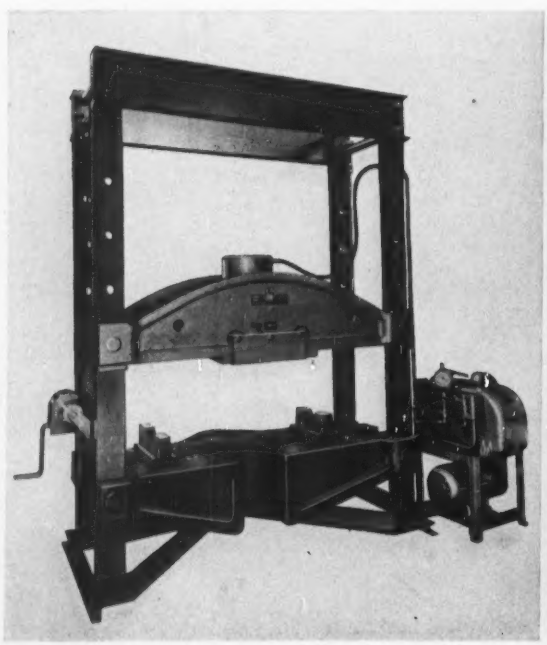
The Abbey Etna Co., Dept. M, 3430 Maplewood Ave., Toledo 10, Ohio, has placed on the market a low-cost machine for the cold-pointing of tubes and bars of steel and non-ferrous metals up to 6 inches in diameter. Four stationary dies are mounted in a fixed spindle head of Nitralloy steel. A cage of annular rolls revolves around the spindle head, the blows being transmitted to the dies through hammer blocks. The inner track for the rolls is in the spindle head and the outer track is fixed in the flywheel.

Production tests indicate that steel tubes up to 2 inches in diameter can be manually fed into the machine by one man with little effort. Non-ferrous tubes up to 2 1/2 inches in diameter and aluminum tubes up to 3 inches in diameter can also be pointed manually. For tubes above these diameters, a power feed is usually necessary.

The power feeders are of the hydraulic type, and for use in tube pointing are fitted with an oscillating hydraulic self-centering vise. For certain other types of work, a rotary air chuck can be fitted to the feeder.

G-E Hard-Surfacing Welding Electrode

A welding electrode for build-up work and hard-surfacing applications, which permits the deposited metal to be machined or flame-hardened, has been announced by the General Electric Co., Dept. M, Schenectady 5, N. Y. This Type W-98, heavy-covered flame-hardening rod can be used in all positions. It is of the steady-spray type, similar to the E-6013 electrode, and can be used in build-up work on road machinery parts,



Open-yoke three-purpose press manufactured by Rodgers Hydraulic, Inc.

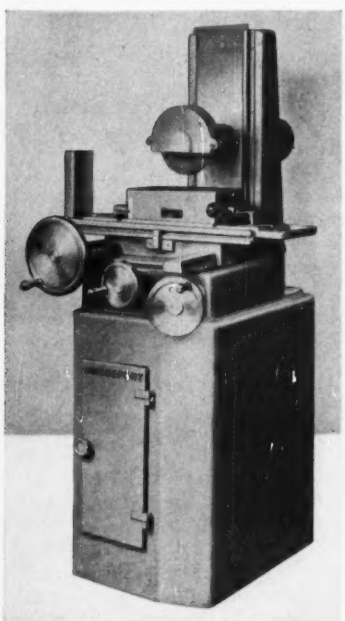
Hard-surfacing a gear wheel by application of new G-E welding electrode

gears, pinion teeth, pump housings, shafts, and sprockets. It is also recommended when a harder deposit metal is desired than that obtainable with electrodes used for underlayers.

Although the type of material involved and the welding conditions can greatly affect the hardness of the deposited metal, the deposit generally has a hardness of approximately 250 Brinell, as welded, and can be flame-hardened to about 350 Brinell. The new electrode is color-marked for identification by a brown end and a white spot. It is manufactured in 1/8 to 1/4-inch sizes, and can be applied by either alternating or direct current.

Bridgeport Surface Grinder

The Bridgeport Surface Grinding Co., Dept. M, 315 Asylum St., Bridgeport, Conn., is manufacturing a surface grinder having a table 6 by 12 inches, with a clearance height under the wheel of 13 inches. This Surf-Ace machine takes a standard 7- by 1/2- by 1 1/4-inch wheel. It has an antifriction ball and roller bearing motorized spindle, which is available in any one of three makes. The main bearing surfaces of this machine, including the vee and flat ways, are thoroughly hand-scraped.



Surf-Ace grinder brought out by Bridgeport Surface Grinding Co.

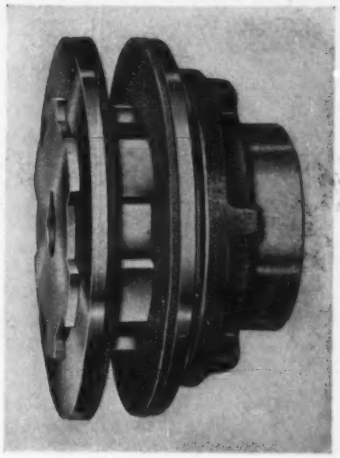
Linde heliarc welding torch with rated capacity of 500 amperes

Heavy-Duty Heliare Welding Torch

Continuous heavy-duty inert-gas arc-welding at 500 amperes is possible with a new water-cooled Heliarc HW-12 torch brought out by the Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, Dept. M, 30 E. 42nd St., New York 17, N.Y. Currents of all types, including straight polarity, direct-current reversed polarity, and alternating current with high frequency, can be used with this torch to weld practically all commercial metals. It can also be used for hard-facing operations.

The torch has an improved water-cooling system that allows uninterrupted service at the full-rated capacity of 500 amperes without overheating. Higher currents are possible with reduced duty cycles. The cooling water flows into the torch body and down around the water jacket that houses the gas cup and returns through a plastic hose that encloses the power cable.

A quarter-turn of the torch cap releases the electrode for replacement. All the electrode adjustments are made through the torch cap. This feature prevents burned fingers from the hot gas caps. Standard 1/4- and 1/8-inch collet bodies are furnished to hold collets ranging from 0.040 to 1/8 inch and 1/8 to 1/4 inch, respectively. Two torch caps are included, permitting the use of either 3- or 7-inch electrodes. The entire torch body is sheathed in tough, heat-resistant plastic.

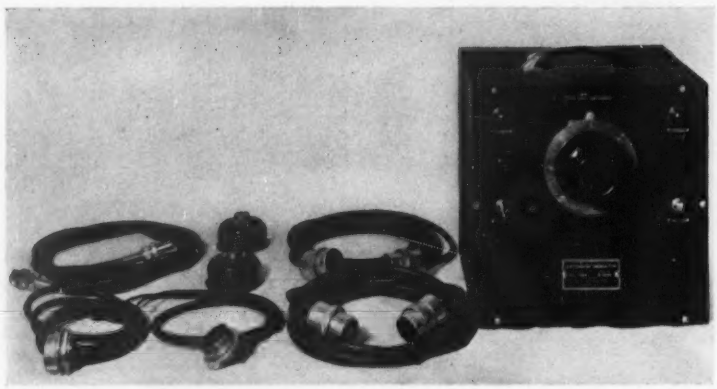


Morse torque-limiting clutch for overload protection

Slip Type Clutches for Overload Protection

A line of adjustable torque-limiting clutches that provide overload protection for machine drives used in a wide variety of equipment is announced by the Morse Chain Co., Dept. M, 7601 Central Ave., Detroit 10, Mich. These clutches are particularly adapted to roller chain drives and are designed to be used in connection with standard Morse Type A plain plate roller chain sprockets. Other types of rotating members, such as gears, pulleys, etc., can be used with the clutches.

The clutches consist of a steel body, two steel clutch plates, two friction discs, a Belleville clutch spring, and a cast-iron adjusting nut. The rotating member is held between the friction discs through spring pressure applied to the clutch plates which slide on splines on the clutch hub. The torque setting of the clutch is obtained by adjusting the spring tension with the threaded thumb-nut. In use the rotating member breaks away from the discs at the overload torque setting. Then the rotating member remains stationary in relation to the clutch hub with the friction torque of the clutch remaining at from one-third to one-half the overload setting. Thus, the clutch rotating member is rendered inoperative until the drive is shut off and the overload condition corrected. The clutches are made in 4 1/2-, 5 1/2-, and 6 1/2-inch diameter sizes with ratings of 55, 121.5, and 260 foot-pounds, respectively.



Equipment that indicates by lamp or buzzer when a test specimen has reached any preset extension up to 0.7 per cent

Extension Indicator for Tension-Loaded Specimens

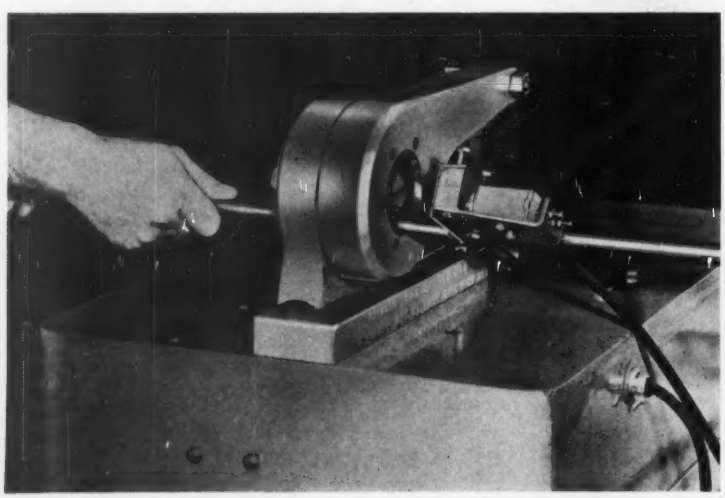
An indicator for measuring the extension of test specimens under tension loading and automatically controlling auxiliary devices is being marketed by the Baldwin-Lima-Hamilton Corporation, Dept. M, Philadelphia 42, Pa. The instrument is applicable to any type testing machine for use in conjunction with any standard high magnification "Microformer" (a miniature variable transformer with movable core) type extensometer of any gage length.

The indicator delivers signals at preset values of extension, using lamps for visual signals and buzzers for audible signals. Electrical relays are used for actuating auxiliary devices such as a load holder, load indicator, or load printer. The only control on the instrument is a dial graduated in tenths of one per cent extension by means of which the signals can be set for the desired extension. The dial is geared to the balancing "Microformer" armature in such a way that dial rotation is proportional to extension within the gage length of the extensometer. The indicator operates on standard 110- to 120-volt alternating-current lines.

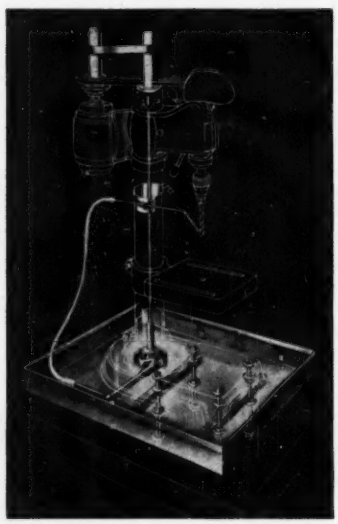
Gage for "Di-Acro" Power Rod Parter

A "Micro-matic" gage, which makes it possible to cut off more than 9000 pieces of bar stock per hour with the "Di-Acro" power rod parter, has been announced by the O'Neil-Irwin Mfg. Co., Dept. M, 559 Eighth Ave., Lake City, Minn. After setting the gage for the desired length of cut, the operator inserts the material in the proper hole in the cutting heads (there are ten hole sizes accommodating stock from 1/16 to 5/8 inch in diameter), and pushes the material through the heads against the gage. The contact thus made is relayed to a solenoid which trips the rod parter and also allows the cut-off part to be ejected.

The operator concentrates on feeding stock through the cutting heads as quickly as he can, no foot or hand control being used. The rate of production is, of course, governed to a certain extent by the lengths of stock to be cut, shorter lengths being gaged and cut faster than longer lengths.



"Di-Acro" power rod parter equipped with "Micro-matic" gage



View showing installation of Wade coolant pump on bench drill press

Coolant Pump for Bench Drill Presses

A coolant supply system designed to provide a low-cost, compact unit is being offered by Wade & Sons, Dept. M, 928 E. Truman Road, Independence, Mo. This unit can be installed in a half-hour or less on any hollow-column bench drill press. No separate motor is required. The pump shaft, driven by the drill press motor, passes through the hollow column of the press to the pump located in the coolant pan. The drill press is mounted in the coolant pan, as shown in the illustration.

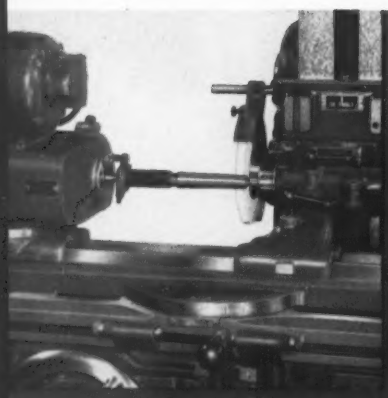
The pan is made of extra-heavy gage steel, and is provided with clips on the side to hold splash shields. The pump intake is screened to keep out drill chips which might clog the flow line.

(*This section continued on page* 253)

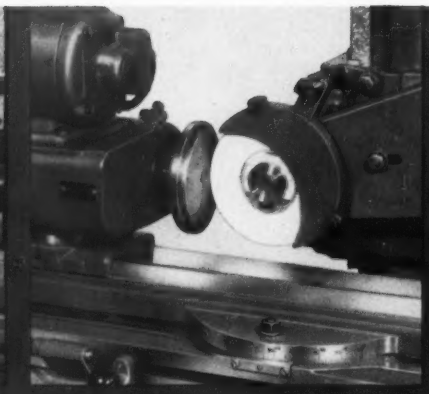
HIGH PRECISION

toolroom
grinding
equipment

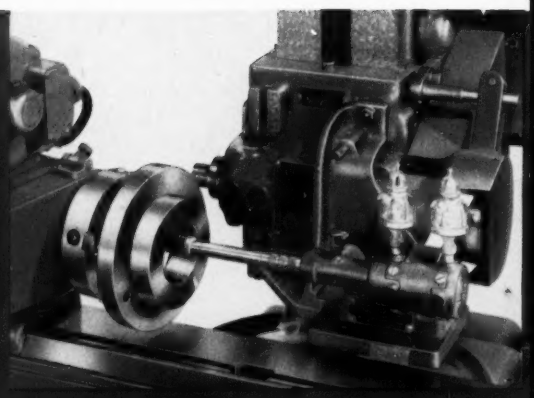
Brown & Sharpe



Taper Cylindrical Grinding



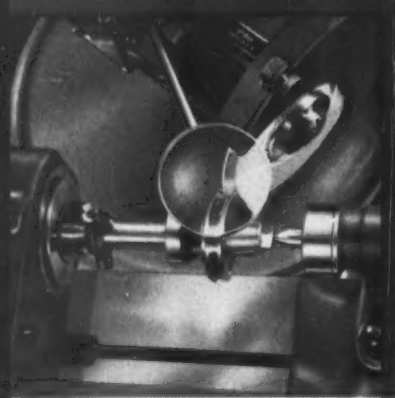
Face Grinding



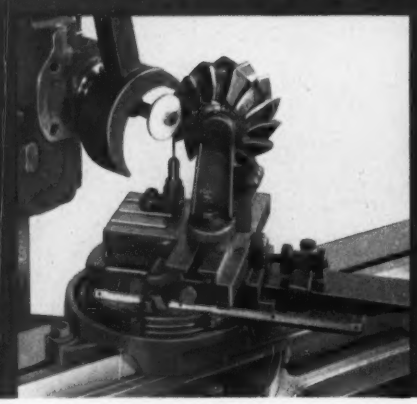
Internal Grinding

"MASTER" of all your toolroom grinding

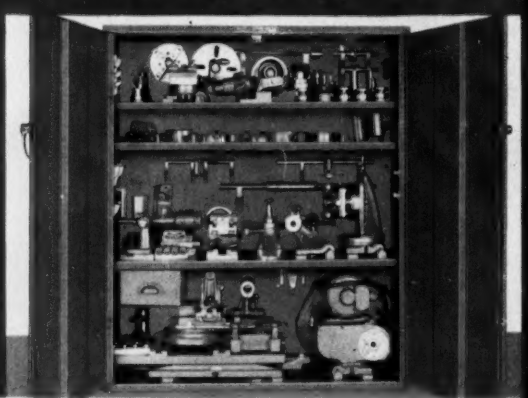
Circular Form Tool Grinding



Radius Grinding Concave Milling Cutter



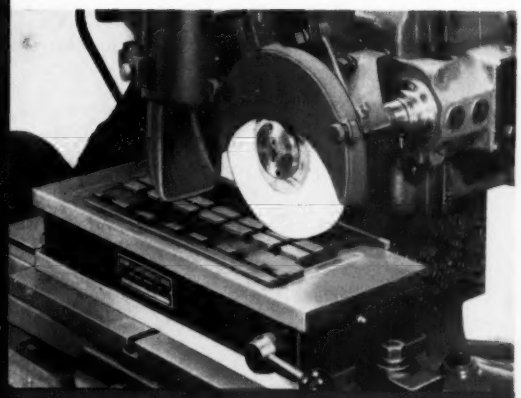
Standard and Optional Equipment Cabinet



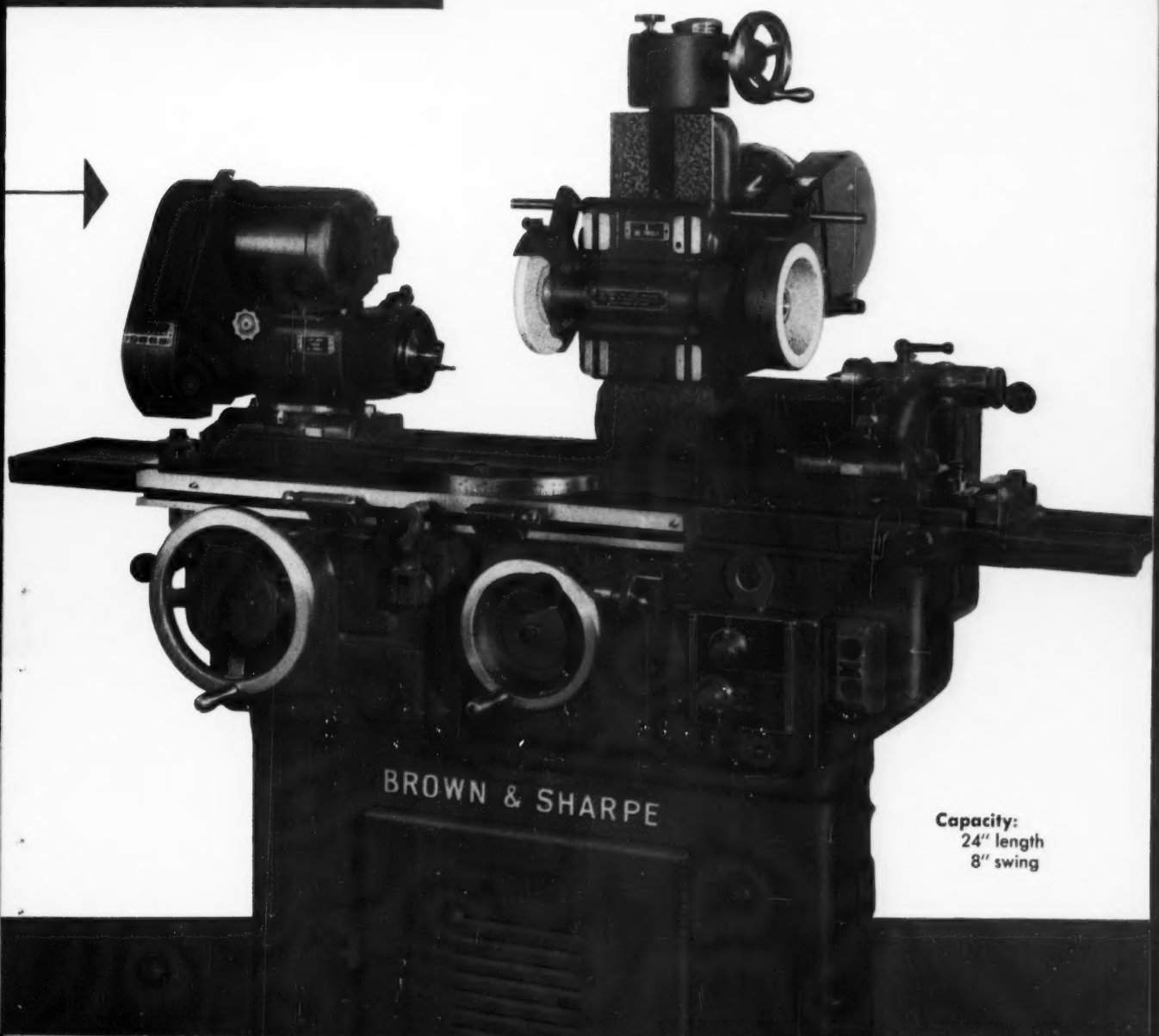
Brown & Sharpe

The No. 13 Universal and Tool Grinding Machine

With the No. 13, you can handle the broad range of precision grinding jobs usually encountered in tool and die shops, research laboratories, cutter and tool maintenance departments, and toolrooms. Outstanding among many features giving broad utility are the machine's swivel-mounted table, headstock, spindle-slide-upright and eye-level vertical adjustment. Three wheel speeds, together with many headstock and table speeds assure fine finish and efficient grinding on all work. A wide selection of optional equipment, as shown in several of the illustrations, also increases the No. 13's work-capacity. It will pay you to investigate all the advantages of this compact, easy-to-operate, most versatile of all Brown & Sharpe Grinding Machines . . . the No. 13.



Surface Grinding

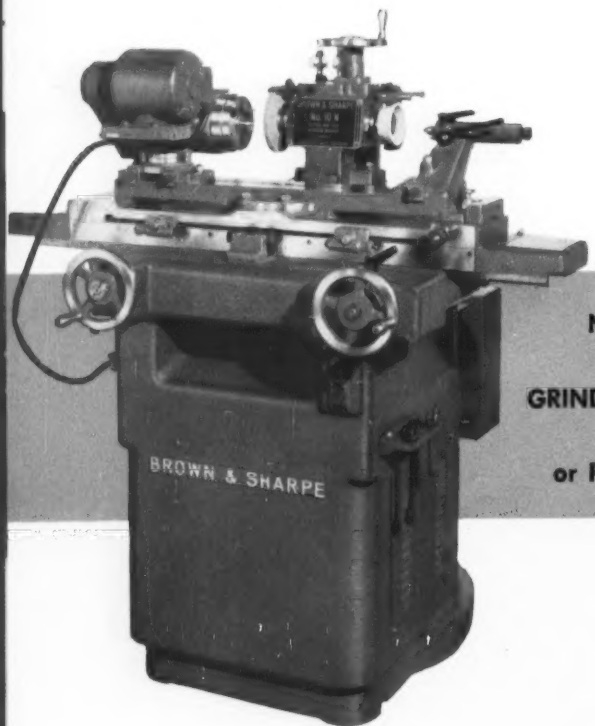


Capacity:
24" length
8" swing

For Precision Cutter and Tool Sharpening that Makes Your Production Equipment "Pay-Off"!

No. 5 CUTTER AND TOOL GRINDING MACHINE

Here's a high quality cutter and tool grinder that combines economy of investment, operation, maintenance, and floor space. On small to average size cutters under 6" dia., the No. 5 assures precision sharpening without excessive equipment investment. It's an ideal machine for "on-the-spot" cutter grinding as well as for cutter maintenance departments.



No. 10N CUTTER AND TOOL GRINDING MACHINE with Universal or Plain Equipment

For the full range of cutter and tool sharpening, the No. 10N offers many outstanding features for easy handling and precision performance. It is illustrated here with Universal Equipment which extends its scope to include light cylindrical, internal, and surface grinding operations.

WRITE FOR COMPLETE INFORMATION ON ANY OF THE BROWN & SHARPE PRODUCTS LISTED BELOW.

Brown & Sharpe

Milling Machines • Grinding Machines • Screw Machines • Cutters
Machine Tool Accessories • Machinists' Tools • Johansson Gage Blocks
Electronic Measuring Equipment • Permanent Magnet Chucks • Pumps

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U.S.A.

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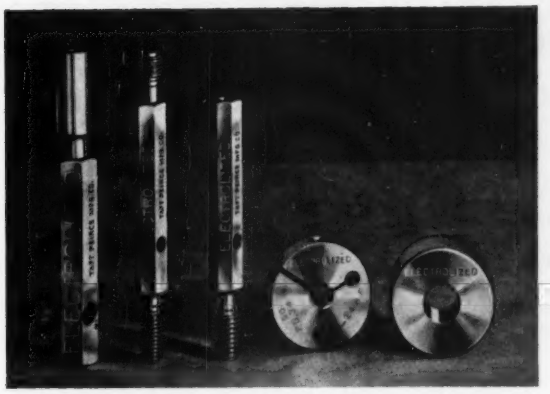
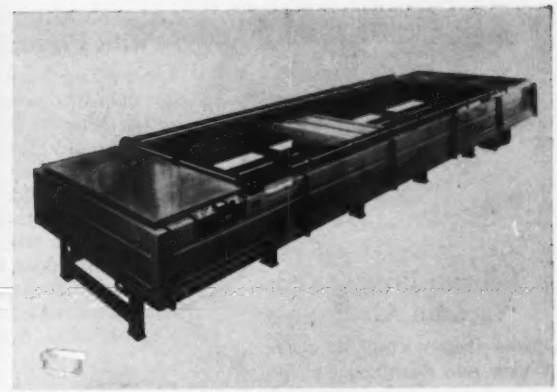


"Electrolized" gages added to Taft-Peirce gaging line



Bruning vacuum printing frame with traveling light

Taft-Peirce "Electrolized" Standard and Special Gages

The Taft-Peirce Mfg. Co., Dept. M, Woonsocket, R. I., has announced the addition of "Electrolized" gages to its line of gaging equipment. Tests have shown that these gages have an exceptionally long life due to the even film of hard, non-magnetic alloy that is applied to all gaging surfaces during the electrolyzing process. This coating, only 0.000025-inch thick, is harder than tool steel.

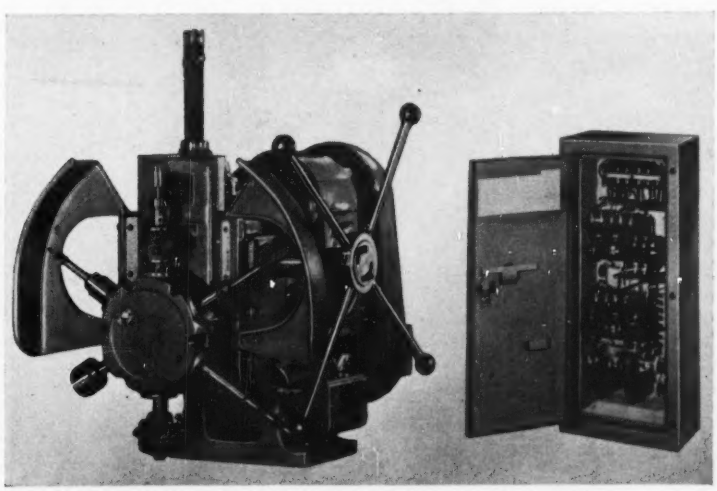
In addition to outstanding durability, the smooth surfaces of "Electrolized" gages reduce friction to a minimum, and resist corrosion to a high degree. Being extremely tough, the gaging surface will not chip, peel, or spall under normal gaging conditions. The electrolyzing process can be applied to Taft-Peirce standard or special gages, and to "Comp-AIR-ator" air gage members.

Vacuum Frame with Traveling Light for Making Large-Sized Prints or Reproductions on Metal

A vacuum printing frame for making prints as large as 8 feet wide by 20 feet 10 inches long has been brought out by the Charles Bruning Co., Inc., Dept. M, 4700 Montrose Ave., Chicago 41, Ill. This printing frame with a traveling light is self-contained except for the lamp transformers. It can be used for exposing all light-sensitive materials, and has the advantage of providing a variable-speed light source that gives uniform light distribution by means of a complete focal plane sweep. All operations are performed without any manipulation or tilting of the frame.

The exceptionally large capacity of this equipment makes it especially well suited for accurate map-copying work and for exact reproductions of large aircraft parts on various materials.

With this frame it is possible to make accurate reproductions of drawn parts on glass cloth, sheet metal, and other mediums. The sheet metal must be suitably coated with a light-sensitive material. Work-pieces such as die parts and tool components can be made direct from drawings reproduced on steel plates.

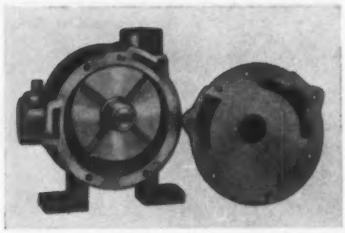


"Burgmaster" drilling and tapping machine for flange mounting

"Burgmaster" Drilling and Tapping Machine

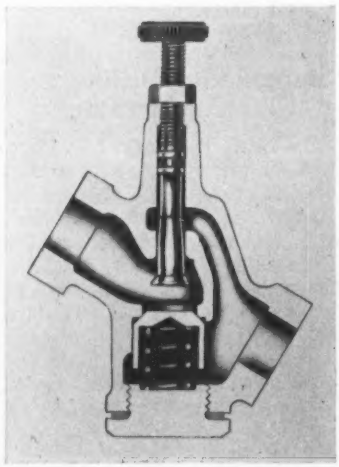
The Burg Tool Mfg. Co., Dept. M, 3743 Durango Ave., Los Angeles 34, Calif., has adapted its standard Model 2A "Burgmaster" drilling and tapping machine for flange mounting. This machine, known as Model 2B, can be mounted on any type of base in a variety of positions. It is designed so that two or more machines can be mounted on the same base at various angles for performing operations on different planes at the same time.

The flange-mounting model is equipped with a separate electrical panel and chain counterweight unit, and can be furnished to order with an automatic hydraulic feed. It has an 8-inch spindle travel and twelve pre-selective spindle speeds ranging from 225 to 3000 R.P.M. The throat depth is 12 inches and the maximum clearance from the nose of the chuck to the bottom of the mounting flange is 8 3/4 inches. The distance from the center of the spindle to the first mounting hole on the flange is 12 3/4 inches. The size of the mounting flange is 15 by 12 inches.



Leiman Pressure and Vacuum Air Pumps

Oilless pressure and vacuum pump of new line designed to eliminate air contamination hazards placed on the market by Leiman Bros., Inc., Dept. M, 102 Christie St., Newark 5, N. J. These pumps are designed to run absolutely dry and are therefore adapted for a wide range of applications in which possible oil contamination is a problem. Lifetime-sealed bearings require no lubrication. The range is up to 11.5 cubic feet per minute, 23 inches vacuum, and 21 pounds per square inch pressure. Pump speeds range up to 1750 R.P.M.

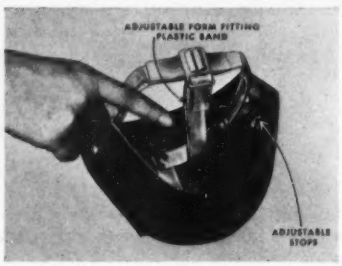


Ross Air Control Valve

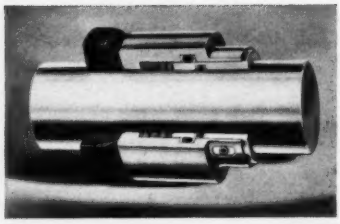
Quick-acting air control valve announced by Ross Operating Valve Co., Dept. M, 120 E. Golden Gate, Detroit 3, Mich. This valve can be used wherever it is necessary to control the flow of air, with split-second timing of piston movement by positive control of the air flow. The valve can be mounted in any position between the operating valve and one or both ends of a cylinder to provide air flow adjustment. It is available in six pipe thread sizes from 1/4 inch to 1 1/4 inches.

Arc-Welding Head Shield with Plastic Headband

Arc-welding head shield designed for operator comfort, announced by the Lincoln Electric Co., Dept. M, Cleveland 17, Ohio. This "Comfort-Shield" has a permanently pliable headband made of plastic material that is adjustable to fit both around and over the head. The plastic does not dry out and curl up but remains soft and pliable. The shield proper is of one-piece molded fiber construction,



and is both lightweight and strong. It has clearance around the head to permit free circulation of air. Stops on each side of the headband can be adjusted to limit the drop of the helmet to any point desired.

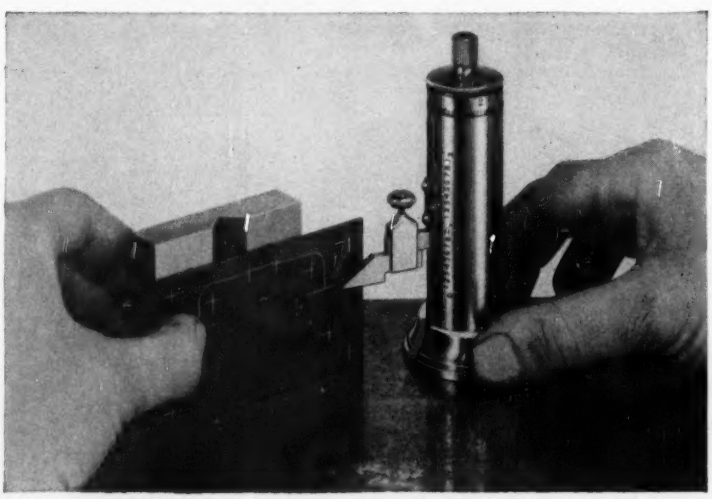


Garlock Mechanical Seal for Pump Shafts

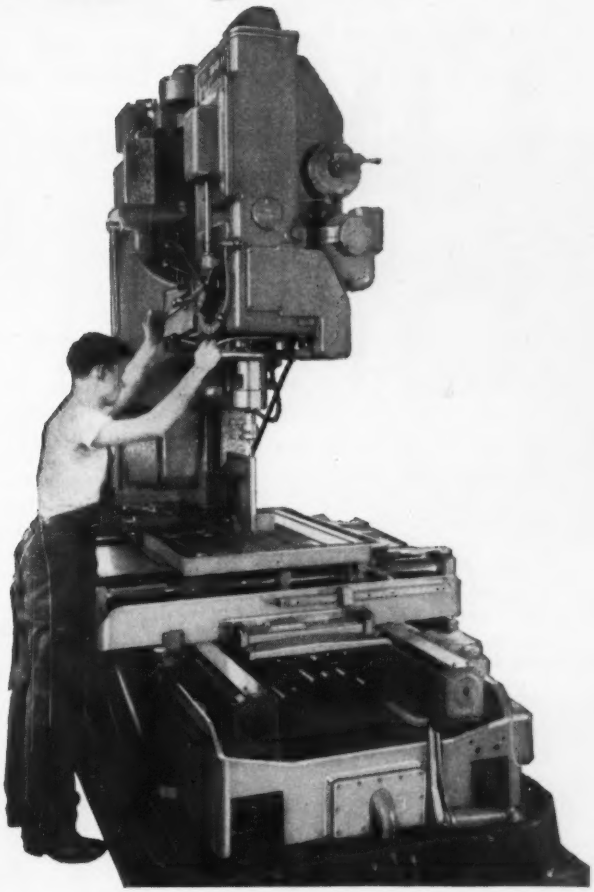
Mechanical seal for rotating pump shafts announced by the Garlock Packing Co., Dept. M, Palmyra, N. Y. Designed to provide leakless operation of rotary shafts on centrifugal pumps handling chemicals, petroleum products, edible liquids, etc. The Type O unbalanced seal is for pressures up to 200 pounds per square inch and the Type OB balanced seal, illustrated, is for pressures up to and over 1000 pounds per square inch. Both types can be supplied with single spring or multiple spring, and in either pin-drive or sleeve-drive construction. The O-rings are available in Teflon, Buna-N, neoprene, or silicone. Metal parts in contact with liquid can be of the kind of metal best adapted for the liquid handled.

Fairfield Height Gage

"Micro-height" gage that combines easy-reading advantages of micrometer caliper with scribing features of vernier height gage. The scriber can be replaced with a dial indicator for determining quickly and accurately the amount of error on center distance or surface measurements. The graduations on the barrel, from 0 to 2 inches, are easy to read. Micrometer adjustments are made with a knurled thimble at top of gage. Can be used to advantage with gage-blocks. Placed on the market by Fairfield Gauge Co., Inc., Dept. M, 178 Herbert St., Bridgeport 6, Conn.



startling savings for you



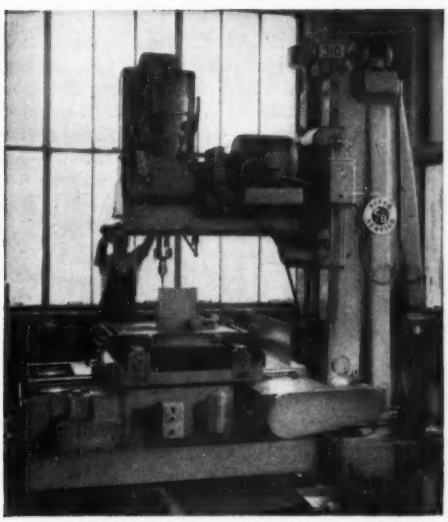


Photo courtesy The American Can Company

Time savings of many hours and sometimes weeks are effected by using the special Cincinnati Bickford fixed arm Precision Drilling Machine—with a Bullard Man-AU-Trol spacing table. Jigs and fixtures are entirely eliminated and accuracy is maintained within limits of .001". Changes from job to job are made at low cost. The results obtained with this installation at the American Can Company are being duplicated in many other plants. This combination may effect startling savings for you.

Ask for circular FH.

CINCINNATI BICKFORD

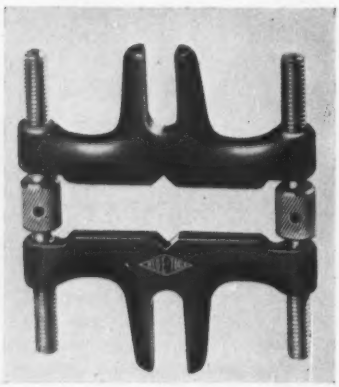
RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

Red-E Cutter Grinder Dog

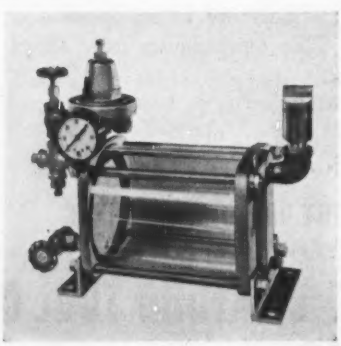
Cutter grinder dog that can be readily adjusted to work of different diameters developed by Ready Tool Co., Dept. M, 554 Iranistan Ave., Bridgeport 5, Conn.

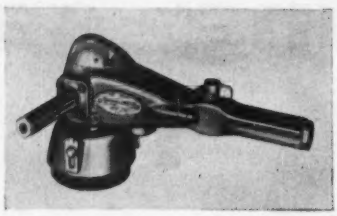


This dog is machined and carefully assembled to insure accurate balance. It is particularly suited for small work that requires the dog to be located close to the faceplate. Two sizes are made—No. 100, accommodating work from 1/8 inch to 1 1/2 inches; and No. 99, from 1/2 inch to 2 1/2 inches in diameter.

Oil-Rite Air-Operated Oil Dispenser

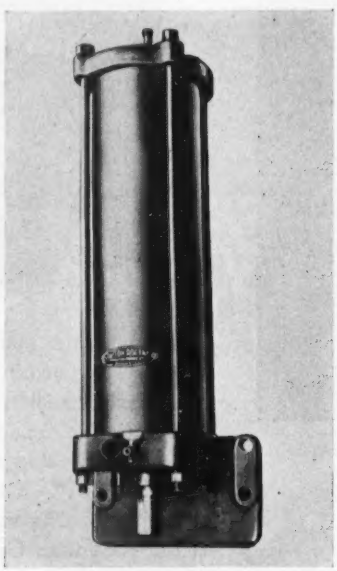
Dispenser designed to feed oil and other fluids by air pressure to elevated, distant, or inaccessible points where gravity feeding is impractical. It is operated by connecting regular air line at pressure of 80 pounds per square inch to regulator on dispenser. The oil flow can be accurately controlled over a wide discharge range. Product of Oil Rite Corporation, Dept. M, 2318 Waldo Blvd., Manitowoc, Wis.





Gearless Angle Grinder

Air-powered, direct-drive angle grinder designed to eliminate the need of gears of any kind. This grinder is said to have sufficient power to provide fast, safe, and efficient operation on practically all surface grinding, cutting-off, and sanding jobs. When operated at an air pressure of 90 pounds per square inch, the spindle speed is 6000 R.P.M. Two types of dead handles are available for this grinder that can be attached in various positions to suit the work. A built-in lubricator provides ample lubrication and the motor is effectively muffled to reduce noise. Product of Ingersoll-Rand Co., Dept. M, 11 Broadway, New York 4, N. Y.



Power Press Pneumatic Counterbalancing Cylinders

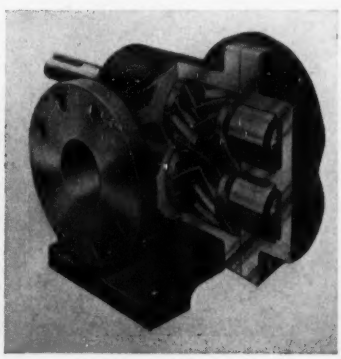
Counterbalancing cylinder designed for easy installation on punch presses, power brakes, and similar equipment, announced by the Dayton Rogers Mfg. Co., Dept. M, Minneapolis 7, Minn. Use of these cylinders is said to result in smoother action, less wear on ram clutch mechanism, and longer life for major wearing parts of large punch presses and power brakes. The cylinders also serve as a brake, eliminating overriding of ram on mid-stroke, and absorbing percussion shock when punch breaks through blank. Made in sizes from 5 to 12 inches.

Air-Operated Riveting Hammer

Pneumatic riveting hammer made by the Brown Tool Mfg. Co., Dept. M, 9422 Trenton Ave., St. Louis 14, Mo. This lightweight powerful hammer has only three moving parts, a speed of about 2800 strokes per minute, and will head 3/16-inch cold duralumin rivets. It is 6 inches long and weighs 3 pounds.

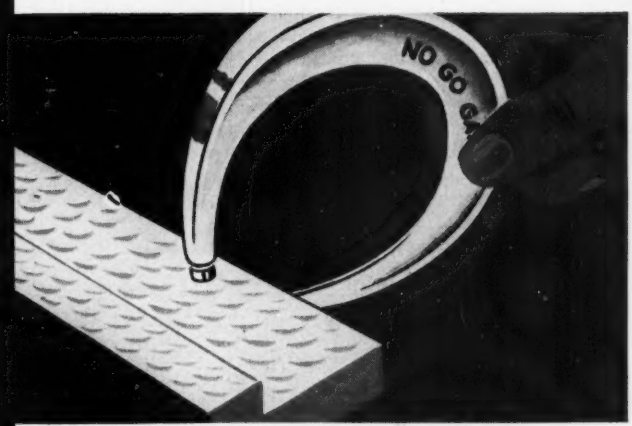
Sier-Bath "Hydrex" Pump

Rotary gear pump brought out by the Sier-Bath Gear & Pump Co., Inc., Dept. M, 9252 Hudson Blvd., North Bergen, N. J. Capacities of the "Hydrex" pump are given as 1 to 500 gallons per minute; pressure 300 pounds per square inch for continuous duty, and 500 pounds per square inch for intermittent service. Only two castings —body and head—are used in the

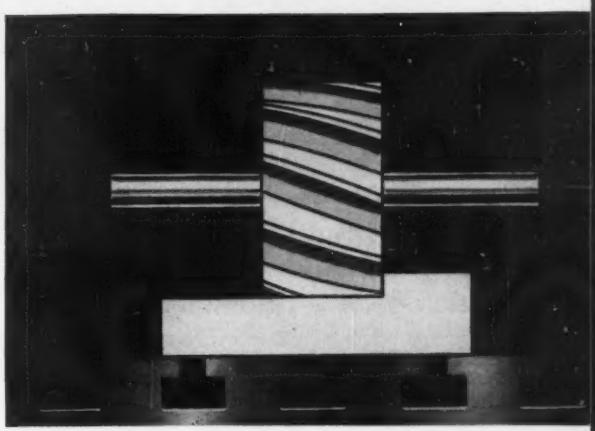


HOW TO END DAMAGED WAYS, PRODUCTION LOSSES

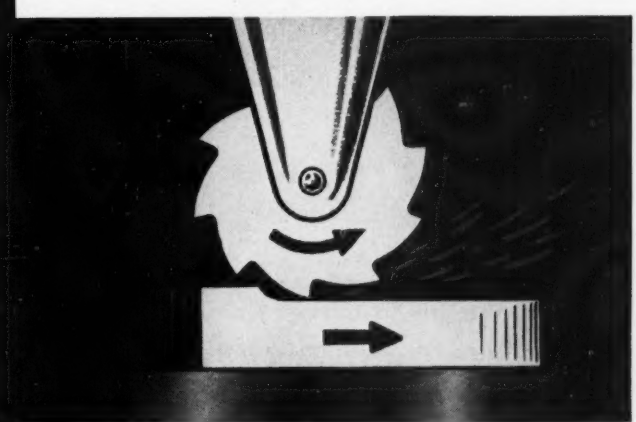
Sunoco Way Lubricant Stops "Jumpy Table"



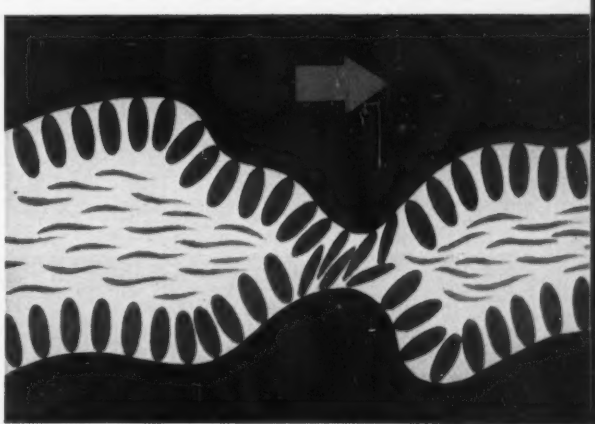
Tool chatter and jumpy table are machining headaches. Too often they cause poor surface finish, failure to hold tolerances, production losses.



Tool chatter is a result of a lack of rigidity in either the machine or the set-up. It is a mechanical problem and no lubricant can lick it.



Jumpy table is a stick . . . slip . . . stick . . . slip action of the table. It is a lubrication problem. Though just as damaging as tool chatter, it is not always detected when the cause of poor surface finishes.



Extreme magnification

Sunoco Way Lubricant cures jumpy table. It contains special compounds that form a film, like the nap of a rug, on the sliding surfaces and minimize the force of both static and kinetic friction.

Why take a chance of damaging your ways? These integral parts of the base casting for your machine are difficult to refinish and costly to replace. For information about Sunoco Way Lubricant, call a Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-7.

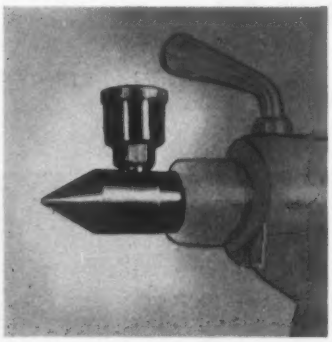
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

pump. Two gears are the only moving parts. These gears or rotors are hydraulically balanced axially and run in roller bearings.

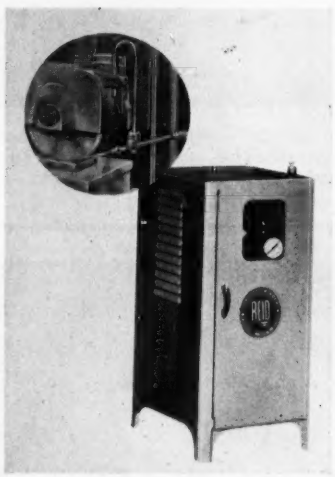


Oil-Jet Center for Lathes and Grinders

Oil-jet center made by Tool Service, Dept. M, Box 10265, Palma Ceia P.O., Tampa 9, Fla., with a 60-degree point tipped over the full length with either hardened high-speed steel or a wear- and heat-resisting cast alloy. The center and its shank are accurately ground. The shank is made of tool steel and left unhardened. Grease cups have either seals or tight-fitting threads, to prevent leakage. Available in Morse and B & S tapers.

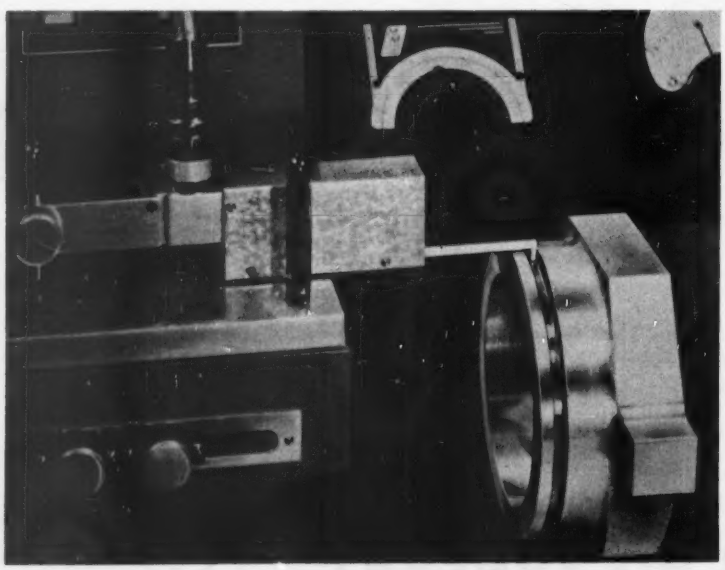
"Capacitrol" Designed for Anticipating Straight-Line Control

Indicating controller featuring anticipating action recently added to the Wheelco Model 200 Series "Capacitrol" line of the Wheelco Instruments Division, Barber-Colman Co., Dept. M, Rockford, Ill. This Model 221C "Capacitrol," has the anticipating action of the "Capaciline" added to the "Electronic Link" to give unvarying straight-line control. Through a unique resistor network and relay circuit, the "Capaciline" anticipates the approach and departure of temperatures caused by various heat transfer lags and load requirements. A thermocouple or a resistance bulb may be used as the sensing element. When a resistance bulb is used, a standardizing unit is added to the instrument. Also available are four additional Model 200 Series "Capacitrols," two for regular on-off control and two for proportioning control. All models utilize the Wheelco Electronic Link.



Profilometer Tracer for Measuring Surface Roughness

Profilometer tracer for measuring surface roughness across the root of flat-bottomed grooves to a depth of 1/4 inch and behind shoulders to a height of 1/4 inch. When measuring crosswise, the device permits tracing for a length of 1/16 inch in grooves 5/32 inch wide, and for greater lengths in wider grooves. This Type KB tracer can also be used for holes as small as 25/64 inch in diameter and all exterior cylindrical and flat surfaces where the part can be mounted on a "Linear Pilotor" with the work surface in a horizontal position. Available from the Micrometrical Mfg. Co., Dept. M, 345 S. Main St., Ann Arbor, Mich.



Coolant Attachment for Grinder

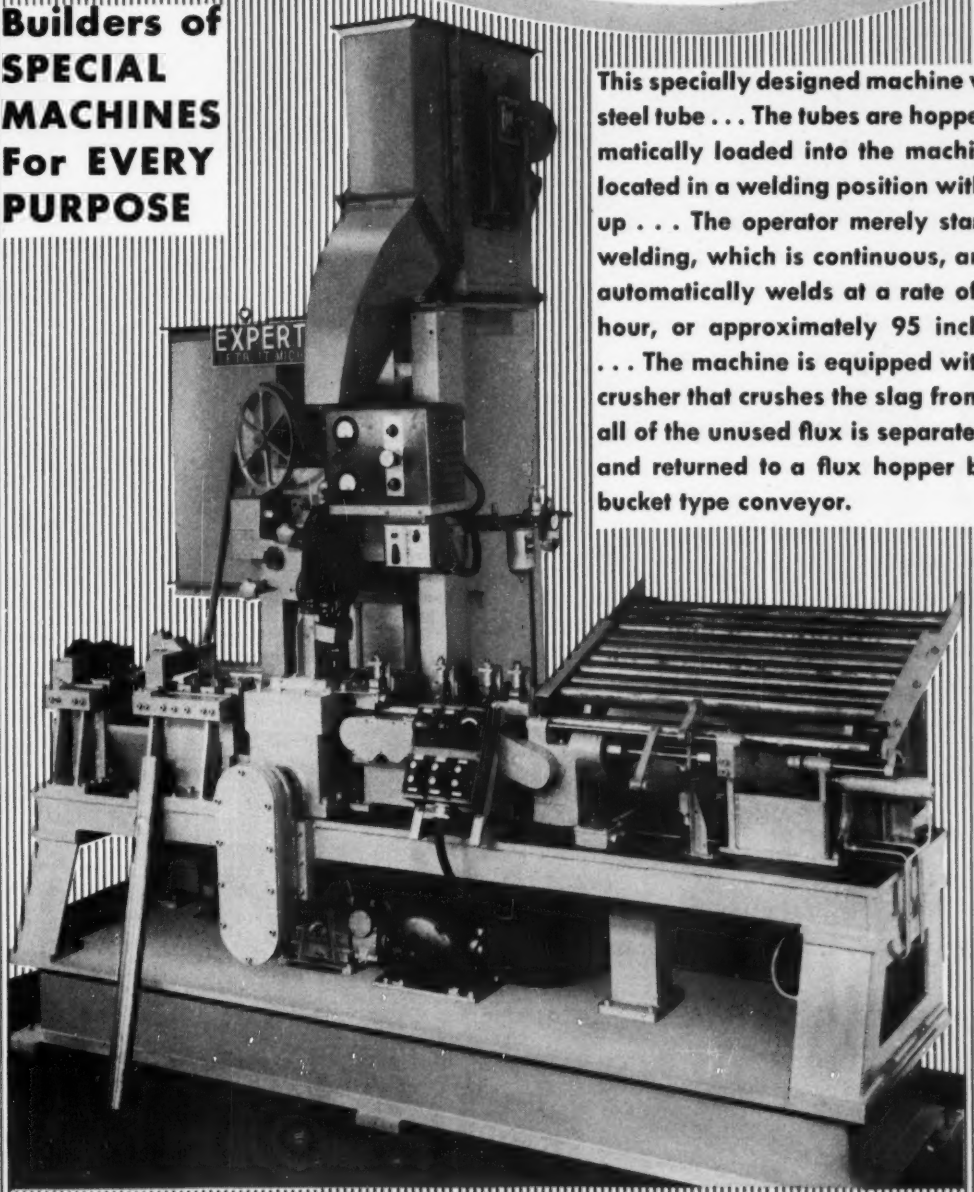
Coolant attachment designed to adapt tool-room grinders for wet grinding without requiring the use of guards around the work. The atomized spray of this attachment permits operation with the work clearly visible. Rapidly evaporating, rust-resistant coolant is sprayed directly at the point of contact between grinding wheel and material, preventing coolant from spattering. The 16- by 16- by 32-inch portable cabinet houses the coolant container and the motor compressor that operates from a 110-volt circuit. Pressure of the spray is controlled by a valve. Manufactured by Reid Brothers Co., Inc., Dept. M, Beverly, Mass.

A CONTINUOUS AUTOMATIC SUBMERGED

Arc Welding Machine

FOR ANY LENGTH OF TUBING

Builders of SPECIAL MACHINES For EVERY PURPOSE

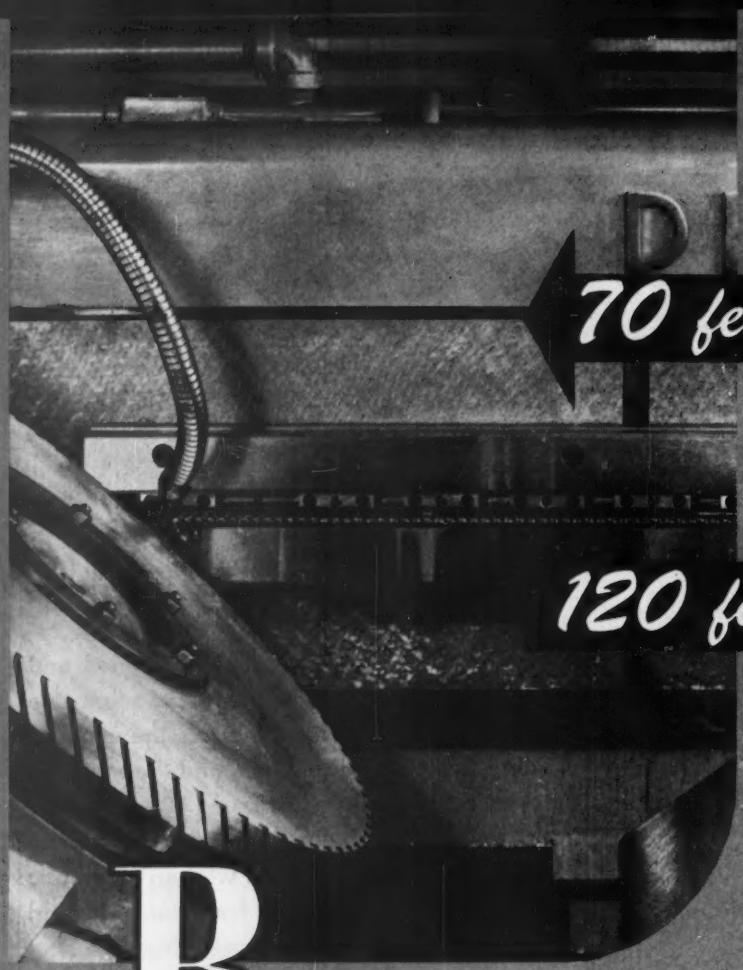


This specially designed machine welds a 42-inch steel tube . . . The tubes are hopper fed and automatically loaded into the machine, turned and located in a welding position with the seam side up . . . The operator merely starts the cycle of welding, which is continuous, and the machine automatically welds at a rate of 136 tubes per hour, or approximately 95 inches per minute . . . The machine is equipped with an automatic crusher that crushes the slag from the weld, and all of the unused flux is separated from the slag and returned to a flux hopper by means of a bucket type conveyor.

FOR FURTHER INFORMATION CONTACT

EXPERT WELDING MACHINE CO.

17144 MT. ELLIOTT AVE. • DETROIT 12, MICH. • PHONE TWINBROOK 1-4227



Broaching compressor wheel slots

Broaching intricately formed slots in aluminum compressor wheels at a speed of 70 feet per minute — with a return stroke of 120 feet per minute — is a practical reality at Detroit Broach. This great broaching advancement is the result of imagination and sound broach-engineering experience . . . a combination forged by years of creative engineering and manufacturing of broaches and broaching tools exclusively.

Whether your application involves a new concept in broaching or the simplest type of conventional broaching, these same factors will benefit you in terms of broaching economy and dependable tooling when you call on Detroit Broach.

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PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on New Catalogues described in the July, 1953, issue of MACHINERY. Circle Key number of item in which you are interested and print name and address on postcard.

NEW CATALOGUES

WELDING ALUMINUM—Reynolds Metals Co., Desk PR, 2500 S. Third St., Louisville 1, Ky. 186-page manual entitled "Welding Aluminum," a revised and enlarged edition containing material on 34 processes suitable for welding, brazing, and soldering aluminum and its alloys. Book contains 35 tables, most of which give information pertaining to machine settings and exact welding procedure for the various processes, as well as 125 charts and illustrations. Can be obtained by engineers, designers, or company executives requesting the manual on a company letterhead to the above address.

DRILLS, REAMERS, AND SPECIAL TOOLS—Whitman & Barnes, 40600 Plymouth Road, Plymouth, Mich. Catalogue 105, containing 176 pages listing, complete as to types and sizes, the company's drills, reamers, and other cutting tools. A technical data section is included. Can be obtained when requested on a company letterhead direct to the above address.

PRECISION GRINDING—Landis Tool Co., Waynesboro, Pa. Booklet entitled "Better Grinding," containing eighty-four pages of information on how to set up grinding jobs, operate precision cylindrical grinders, take proper care of them, and turn out better grinding jobs. The publication is intended to assist operators of all precision cylindrical grinders 1

HEAT-TREATMENT—Meehanite Metal Corporation, New Rochelle, N. Y. Booklet entitled "Principles of Heat-Treatment," containing forty-three pages of information on various heat-treating operations as they pertain to Meehanite metal, and illustrating the use of heat-treated Meehanite castings in a variety of engineering applications. 2

HACK AND BAND SAWS—Capewell Mfg. Co., Hartford, Conn. Three booklets entitled "How to Use Hand Hack Saw Blades," "How to Use Power Hack Saw Blades," and "How to Use Band Saws," containing helpful information on selecting the correct blade for the job; determining speeds and feeds; detecting sawing difficulties; and checking for machine maintenance. 3

TITANIUM—Mallory-Sharon Titanium Corporation, Niles, Ohio. Booklet entitled "Properties of Titanium and Titanium Alloys," listing the general properties of titanium, standard product classifications, and testing procedures, together with specific properties of the five types of titanium and its alloys supplied by the corporation 4

TRACER-CONTROLLED MILLING—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 490-2, describing and illustrating the P & W-Keller milling machine that is controlled by a sensitive tracer and operated by simple electrical circuits, for producing complicated work in aircraft and ordnance plants 5

HELIARC TORCHES—Linde Air Products Co., A Division of Union Carbide and Carbon Corporation, New York City. Form 7979, entitled "Heliarc Torches: Your Best Buy for Inert Gas Shielded Arc Welding." Included in the catalogue are charts giving selection data on electrodes, nozzles, and argon cylinders. 6

RECTIFIERS—General Electric Co., Schenectady, N. Y. Bulletin GEC-970, describing the company's line of manually controlled and automatically regulated metallic rectifier power supplies for electroplating and similar processes, and listing ratings and dimensions. 7

CHAMFERING MACHINE—Modern Industrial Engineering Co., Detroit, Mich. Bulletin 2029, on the Burr-Master flywheel ring gear deburring and chamfering machine, describing how the machines chamfer both tooth edges and root with a generated cutting action. 8

BURS—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Booklet containing forty pages of data on three types of Keller burs—the ground high-speed steel bur, the ground carbide bur, and the file cut bur. 9

INTEGRAL-HORSEPOWER MOTORS—Newman Industries (America) Inc., New York City. Catalogue containing dimensions and illustrations of the Newman totally-enclosed, fan-cooled, squirrel-cage motors up to 30 H.P., and drip-proof, wound-rotor and squirrel-cage motors up to 125 H.P. 10

WIPING TIP GRINDER—Mallard Industries, Inc., (distributor Kodiak Corporation, Cleveland, Ohio). Folder descriptive of the Contour-Matic wiping tip grinder for grinding a wide variety of turbine bucket wiping tips economically. 11

WHEEL FORMING ATTACHMENT—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 543-1, on the Diaform wheel forming attachment, illustrating various applications of the attachment in forming and re-truing complex forms on grinding wheels. 12

COOLANT-LUBRICANT—Sheer-Speed Chemical Products, Division of Michigan Tool Co., Detroit, Mich. Bulletin 5053, giving general operation instructions for Sheer-Speed soluble oil for use in practically all types of metal-cutting, grinding, and forming operations. 13

BENCH LATHES—South Bend Lathe Works, South Bend, Ind. Catalogue 5304, covering the company's line of 9-inch precision bench lathes for the production of small accurate parts in the plant, tool-room, and machine shop. 14

ADJUSTABLE SPEED DRIVE—Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin D-2102, outlining operating functions and performance features of the Reliance V-S, Jr., adjustable speed drive of from ¾ to 3 H.P. Typical applications are illustrated. 15

SOLDERING IRONS—General Electric Co., Schenectady, N. Y. Bulletin GEA-4519, on industrial soldering irons. A chart describing the purpose of flux and which flux is best suited to the base material or applied finish is presented. 16

FORGING—Heppenstall Co., Pittsburgh, Pa. Booklet entitled "This is Heppenstall," describing the company's facilities for producing steel and forging it into such products as die-blocks, shear knives, and materials-handling equipment 17

MATERIALS-HANDLING EQUIPMENT—Allied Mfg. & Sales Co., Chicago, Ill. 36-page catalogue, covering the Grand line of materials-handling equipment and C-clamps, Saegen winches and hoists, and Caldwell equalizing slings. 18

HIGH-SPEED HEATING FURNACES—Surface Combustion Corporation, Toledo, Ohio. Bulletin SC-162, on the company's line of high-speed heating furnaces for press forging, upsetting, extruding, and stress relieving of ferrous and non-ferrous metals. 19

TURBINE-BLADE AIRFOIL GRINDER—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 551, providing a description and specifications of the P & W turbine-blade airfoil grinder for turbine-blade production. 20

BORING AND MILLING MACHINES—DeVlieg Machine Co., Detroit, Mich. Bulletin describing the range of Spiramatic Jigmil precision boring and milling machines manufactured by the company. Constructional features are explained and typical examples of set-ups illustrated. 21

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ELECTRODES—Air Reduction Sales Co., New York City. Booklet ADC 650, consisting of a 50-page pocket guide to Airco electrodes. Over thirty electrodes are described according to chemical analysis, procedure for welding, and application. 22

STANDARD CASTINGS WITHOUT PATTERNS—Myerstown Foundry & Machine Works, Inc., Myerstown, Pa. Catalogue listing and illustrating standard shapes and forms cast in iron, semisteel, and non-ferrous metal available without patterns from the foundry. 23

SINTERED METAL PARTS—United States Graphite Co., Saginaw, Mich. Catalogue containing factual information on Gramix sintered metal parts. A section illustrates many typical parts that have proved successful in difficult applications. 24

ELECTROFORMING—Bonz Engineering Corporation, Glendale, Calif. Booklet on electroforming—what it is and where it is used. The company's facilities for designing, manufacturing, and testing electroforming products are described. 25

SURFACE GRINDERS—DoAll Co., Des Plaines, Ill. Catalogue describing a wide variety of DoAll precision surface grinders for tool-room and production grinding operations. Outstanding features are explained in detail..... 26

PORTABLE STRAIN INDICATOR—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 4103, descriptive of the improved SR-4 Model M portable strain indicator, designed for field and laboratory measurement of strain in structures and machines. 27

DESCALING STEEL SHEETS—American Wheelabrator & Equipment Corporation, Mishawaka, Ind. Bulletin 914, giving a case history with performance data showing how hot-rolled sheets are descaled by airless blasting. 28

POWER PRESSES—Clearing Machine Corporation, Chicago, Ill. Bulletin 225, descriptive of double-crank straight-side power presses in sizes for producing the middle range of stampings requiring from 100 to 250 tons capacity. Specifications are given. 29

STAINLESS STEEL POWDERS—Vanadium-Alloys Steel Co., Latrobe, Pa. Bulletin 3, describing the physical properties of prealloyed stainless steel powders and the mechanical properties that can be obtained by various procedures. 30

HEAT-TREATING TOOL STEEL—K. H. Huppert Co., Chicago, Ill. Bulletin on helpful hints in heat-treating tool steel, intended as a guide to good heat-treatment practice in small machine, tool, and die shops. 31

AIR AND HYDRAULIC CYLINDERS AND VALVES—Rivett Lathe & Grinder, Inc., Boston, Mass. Bulletin describing the complete Rivett line of valves and cylinders to meet requirements of any air or hydraulic circuit. 32

PRECISION LATHES—Louis Levin & Son, Inc., Los Angeles, Calif. Catalogue L, describing Levin precision lathes designed for the manufacture of parts too small to be handled in the usual engine or toolmaker's lathe. 33

WOUND-ROTOR MOTORS—Louis Allis Co., Milwaukee, Wis. Bulletin 1300, covering the company's line of wound rotor motors, ½ to 1000 H.P., and showing how these units are suited to particular jobs. 34

ALUMINUM CAST PLATE AND BAR—Reynolds Metals Co., Louisville, Ky. Booklet describing Reynolds aluminum cast plate and bar, a new product available for use in tools, dies, and fixtures 35

BARREL FINISHING—Minnesota Mining & Manufacturing Co., St. Paul, Minn. Manual on the "Honite" and "Super Honite" barrel finishing compounds for deburring and burnishing small metal parts. 36

SAWS—Motch & Merryweather Machinery Co., Cleveland, Ohio. Bulletin 100-CT, descriptive of M & M saws for cutting off, slitting, and slotting stock, and explaining the principle of the Triple-Chip method. 37

FILTER FOR PAINT SPRAY BOOTH WATER—Industrial Filteration Co., Lebanon, Ind. Leaflet descriptive of a continuous filtration system for the removal of paint sludge and particles from paint spray booth water. 38

PROFILOMETER—Micrometrical Mfg. Co., Ann Arbor, Mich. Bulletin LT77, explaining the practical features and applications of the Profilometer, a direct-reading shop instrument for measuring surface roughness. 39

SLOTTING AND MILLING MACHINES—Pellow Machine Co., Detroit, Mich. Leaflet descriptive of the Pellow duplex continuous slotting and milling machine, giving specifications and examples of the work produced. 40

FRICTION AND HYDRAULIC DRIVES—Twin Disc Clutch Co., Racine, Wis. Booklet introducing five new friction and hydraulic drives for powered equipment, and showing their application in various industries. 41

DRILLING MACHINES—Wales-Strippit Corporation, North Tonawanda, N. Y. Catalogue DM, featuring two models of Wales drilling machines for locating, drilling, reaming, and boring holes 42

SHARPENING FILES—Ashland Engineering Co., Ashland, Mass. Leaflet describing the Sharp-All kit containing a solution for cleaning files and conditioning them for further use. 43

DIAL CENTER FINDER—Waltham Dial Gage Co., Stow, Mass. Leaflet describing the Waltham dial center finder for locating work-pieces on jig borers, milling machines, or lathes. 44

STAINLESS STEEL—Carpenter Steel Co., Reading, Pa. Folder listing the advantages of Type 443 (Carpenter No. 3) heat-resisting chromium steel and comparing it with Types 304 and 430. 45

RECIRCULATING HEAT-TREATING FURNACES—Despatch Oven Co., Minneapolis, Minn. Bulletin 81, showing Despatch furnaces in operation in various plants to meet specific requirements. 46

BEARING CALCULATOR—Aetna Ball & Roller Bearing Co., Chicago, Ill. Calculating device to aid bearing users in selecting the proper size of ball thrust bearings. 47

AIR CYLINDERS—Carter Controls, Inc., Lansing, Ill. Bulletin 100, featuring the new Carter cylinders, and giving data on the range of seven standard diameters in the line. 48

SCREW PUMPS—Sier-Bath Gear & Pump Co., Inc., North Bergen, N. J. Bulletin SE-5 on Sier-Bath external gear and bearing bracket type screw pumps for non-lubricating fluids and semi-fluids. 49

HARD-FACING ALLOYS—Wall Colmonoy Corporation, Detroit, Mich. Bulletin 104, showing typical uses of Colmonoy No. 6, an all-purpose hard-facing alloy, and giving application information. 50

WORK DRIVERS—Skinner Chuck Co., New Britain, Conn. Catalogue giving complete information and specifications on the company's line of GF work drivers for turning between centers. 51

ELECTRODE HOLDER—Sciaky Bros., Inc., Chicago, Ill. Bulletin 310-10, covering the Sciaky micrometric upper electrode holder that fits any electrical-resistance spot welder. 52

JOHANSSON GAGE-BLOCKS—Swedish Gage Co. of America, Dearborn, Mich. Folder descriptive of Johansson gage-blocks and accessories for industrial and scientific measurements. 53

GEAR FINISHING MACHINES—Michigan Tool Co., Detroit, Mich. Bulletin V-53, outlining the advantages of the V-series gear finishing machines, together with machine details 54

LUBRICANTS—Alpha Corporation, Greenwich, Conn. Bulletin 100, giving technical details on the various industrial grades and compositions of Molykote lubricants. 55

POLISHING MACHINES—Central Machine Works, Worcester, Mass. Folder descriptive of the new H-M series of hydraulically operated polishing machines made by the company. 56

VISES—Chicago Tool & Engineering Co., Chicago, Ill. Catalogue descriptive of Palmgren angle vises, drill press vises, rotary tables, and other machine tool accessories. 57

PROJECTION WELDER—Sciaky Bros., Inc., Chicago, Ill. Bulletin 305-1, on the Sciaky air-operated, press type, three-phase, electric-resistance projection welder. 58

LIFTING MAGNETS—O. S. Walker Co., Inc., Worcester, Mass. Folder descriptive of the new line of Walker magnets for holding work-pieces weighing up to 48,000 pounds. 59

NICKEL STEEL TUBING—International Nickel Co., Inc., New York City. Reprint entitled "New 9 Per Cent Nickel Steel Tubing—Properties and Processing." 60

MARKING DEVICES—Newark Stamp & Die Works, Inc., Newark, N. J. Catalogue 53, descriptive of the company's line of marking devices and equipment. 61

Product Information Service

Use the postage-free postcard below for requesting further information on New Catalogues. Simply circle the numbers of the items in which you are interested. Please print your name and address.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	:	:	:	:	:	:	:	:	:

PLEASE PRINT M-7/53

Name .....

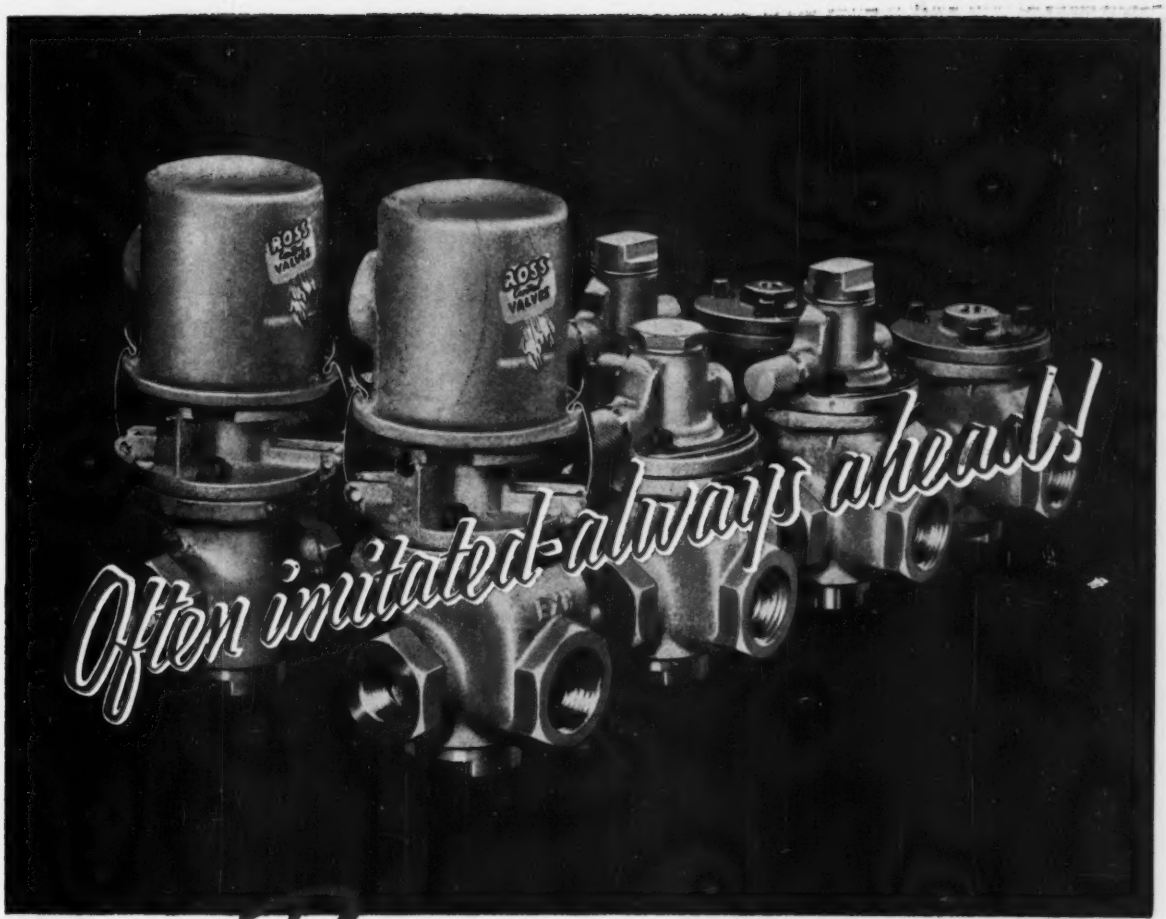
Title .....

Firm .....

Street .....

City ..... Zone ..... State .....

This card is void after October 1, 1953



Ross In-line Valves

The reputation and performance of Ross In-line Series Valves are so outstanding that imitations are constantly being attempted. Through constant improvements, the Ross In-line Series remains the leader and the envy of the trade. Here's why—

- ***Dependable***—10 to 20 million maintenance-free cycles, and many more tens of millions of life-cycles, are not uncommon.
- ***Speedy***—split second operation; oversized exhaust.
- ***Low current consumption for solenoid models***—inrush of 1.2 amps @ 110/60.
- ***Positive seal***—poppet construction; Hycar seats.
- ***Easy maintenance***—only a few moving parts; can be disassembled without breaking line connections — solenoids readily accessible.
- ***Many modifications***—vacuum, air, and liquid service; various pressures; available for AC or DC solenoids or air actuation with or without sequence timing; interchangeable heads.

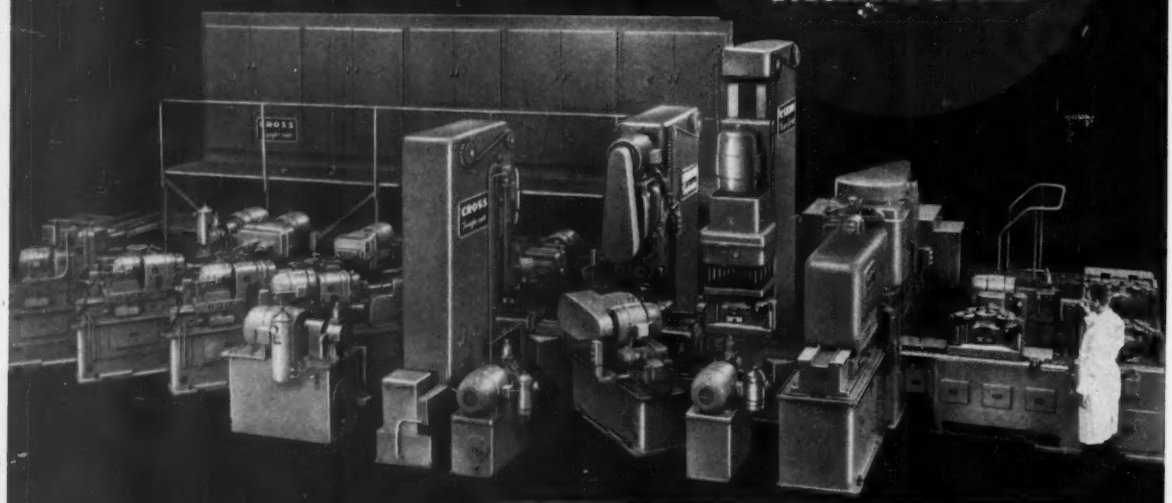
Write for full information on the Ross In-line Series

Ross OPERATING VALVE COMPANY

110 E. GOLDEN GATE AVENUE • DETROIT 3, MICHIGAN

Another Transfer-matic by Cross

Completely Machines Exhaust Manifolds



★Machines right and left exhaust manifolds completely — 42 milling, drilling, boring, chamfering, and tapping operations.

★230 pieces (115 right and 115 left) per hour at 100% efficiency.

★Ten stations—one loading, one unloading, three milling, three drilling, one boring, one tapping.

★Palletized work holding fixtures with power wrenches for automatic operation.

★Cross-Drive for milling cutters.

★Other features: Built-in chip conveyor and automatic removal of chips from fixtures after each cycle, pre-set tools, J.I.C. standard construction, automatic lubrication, hardened and ground ways.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Between Grinds

By E. S. Salichs

The Damage Done

Ten minutes, the length of time a tornado played havoc on June 9 at the Norton Co. plant in Worcester, Mass., resulted in damage estimated at over one million dollars. Employes took cover under machines, tables, and desks as the twister struck just a few minutes after five o'clock. Eight persons were injured. The steel decking of the roof was blown off, windows were smashed, and Line 1, which handles heavy castings, was covered with the most debris. About thirty automobiles in the parking lot were demolished and several others were catapulted 100 feet away. The cafeteria, which recently had received an award in a food service contest, became a mass of rubble.

Turning Out Tokens

Bright brass coins slightly smaller than a dime are being turned out—600,000 of them every eight hours—in seven stamping presses by the Scovill Mfg. Co. in Waterbury, under a rush contract for the City of New York. Residents of the city might wish the plant wouldn't be so terrifically efficient, because the sooner the city gets the tokens, the earlier the subway fares you know what.

Welds Behind Walls

Stony Mountain Penitentiary in Winnipeg, Canada, gives a welding course to properly matriculated inmates. The Lincoln Electric Co., which has an established welding school with different admission requirements, recently heard about a twenty-nine year old shopbreaker with a fifteen-month sentence who asked the Canadian court to add nine months to his term because he wanted to finish the welding course at the prison. There's nothing like a diploma on taking leave of your alma mater!

Feed at Sight, Too?

Sight Feed Generator Co. recently held an open house to introduce an addition to its Sight Feed line.

D'oubtless

D'orium is a new process giving aluminum a gold finish so realistic that it is almost impossible to detect the difference by eye alone between it and genuine gold, so they say. Six shades of gold can be achieved without, mind you, using gold to obtain the lifetime finish.

Three Down, One to Dough

The National Biscuit Co. plant in Chicago has installed twelve ovens, each as long as a football field. Now some jolly baker might mold a batch of bread dough into pigskins and bake it to a leather!

RYAN PRODUCTION EXPERT—Lawrence M. Limbach (author of the ten-page article beginning on page 172) has now been works manager at the Ryan Aeronautical Co. for a year. He is a native of Massillon, Ohio. Staunton Military Academy and the Case Institute of Technology prepared him for his career in metallurgical engineering. In 1933, he joined the Republic Steel Corporation in Cleveland as an apprentice. Advancing in jack-in-the-beanstalk strides, he became manager of operations at the Steel and Tube Division. But Mr. Limbach visited his mother periodically in California, and was impressed with outdoor living there, along with career-wise opportunities for forging ahead. So he tied up with Ryan and moved his family to San Diego. As works manager of the plant, his responsibility includes supervision of all the production and factory services division and their supporting departments. As pater of the patio, his responsibility includes keeping his two daughters and son busy with swimming and tennis activities in which the family shines along with the California sun!

Alphons J. John — Winner of The Industrial Press Award

ALPHONS J. JOHN, director of advertising and public and employe relations, of the Kearney & Trecker Corporation, Milwaukee, Wis., is the 1953 recipient of The Industrial Press Award of $1000. The publishers of MACHINERY give this Award to the advertising man who each year makes the best documented presentation to his management to prove the need for a specific advertising program, offering at the same time a program to fill that need. Mr. John was formally presented with the Award on June 22 at the annual convention of the National Industrial Advertisers Association, held at the Hotel William Penn, Pittsburgh, Pa. Keith F. Gallimore, Jr., of Klau-Van Pietersom-Dunlap, Inc., Milwaukee, Wis., Kearney & Trecker's advertising agency, collaborated in preparing the winning presentation.

In addition, certificates of honorable mention were given to George H. West, advertising manager of the Consolidated Engineering Corporation, Pasadena, Calif.; Ernest T. Giles, of Ketchum, MacLeod & Grove, Inc., Pittsburgh, Pa., for his presentation on behalf of the A. M. Byers Co.; and Joseph Serkowich, advertising manager of LeTourneau-Westinghouse Co., Peoria, Ill.

Alphons J. John, director of advertising and public and employe relations, of Kearney & Trecker Corporation, winner of the award

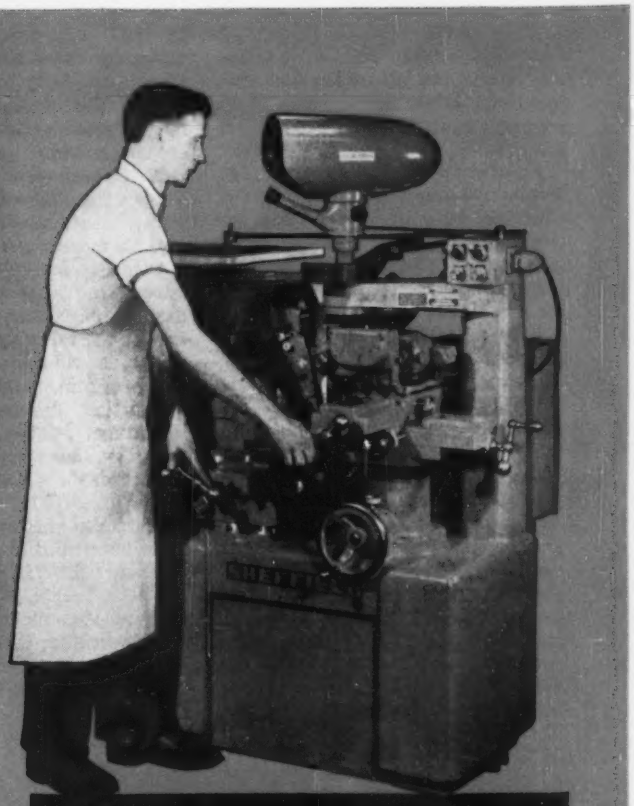
Entries in the contest were carefully considered by a panel of judges selected by the Awards Administrative Committee of the N.I.A.A. The panel consisted of W. F. McGuiness, president, the Elastic Stop Nut Corporation of America, Union, N. J.; Paul E. Fenton, vice-president, the Scovill Mfg. Co., Waterbury, Conn.; Miss Vivien Kellems, Kellems Co., Stonington, Conn.; Charles Paist, director of sales and advertising, the National Metal Edge Box Co., Philadelphia, Pa.; and G. Earle Walker, vice-president, Aircraft-Marine Products, Inc., Harrisburg, Pa.

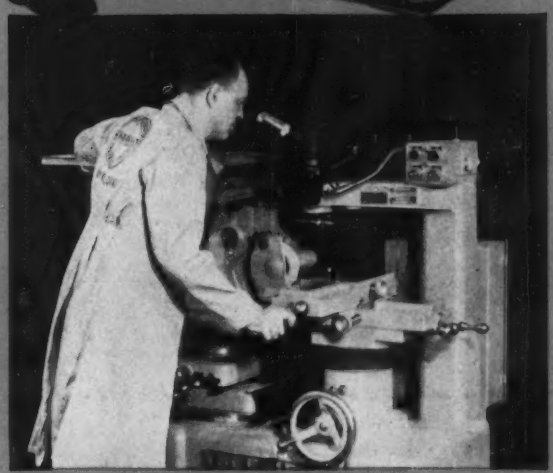
The winning presentation focussed attention on problems that confront Kearney & Trecker, as well as other machine tool builders, stemming from the feast-or-famine nature of their business. On upswings in the business cycle, it is practically impossible for machine tool builders to meet demands for their products. This is particularly true in times of national emergency, when both producers of defense material and of consumer items are competing for the same equipment.

Judging the 1953 entries for The Industrial Press Award (left to right) Paul E. Fenton, vice-president, Scovill Mfg. Co.; Miss Vivien Kellems, Kellems Co.; W. F. McGuinness, president, Elastic Stop Nut Corporation of America; Charles Paist, director of sales and advertising, National Metal Edge Box Co.; and G. Earle Walker, vice-president, Aircraft-Marine Products, Inc.

Grind High Precision Profiles Directly from the Drawing *with*

SHEFFIELD'S MICRO-FORM GRINDER





Features

- Grinds both flat and circular profiles
- No restrictions on profile intricacy
- No templates needed
- Perfect toolroom accuracy
- Saves up to 75% on profile work
- Final accuracy checked while work is still on the grinder
- Accuracy not affected by wheel wear
- No special wheel dressing required as wheel can be set at any angle—fewer wheels are needed
- Diamond impregnated wheels used in grinding carbides last longer—no waste as no special dressing is required
- Multiple work parts ground simultaneously
- Grinds any material including carbides
- Controlled by 50:1 pantograph and 30 power scope and viewing screen

For full details and specifications ask your Sheffield representative for Bulletin MFG-122-51 or write us direct.

6113

the **Sheffield** corporation

DAYTON 1, OHIO, U.S.A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS

Representatives in Principal Countries • In Australia, the Sheffield Corp. of Australia Pty. Ltd., Melbourne

On downswings in the cycle, the problem becomes one of stabilizing production schedules and employment levels at a point that assures a reasonable return on investment.

Studies made by Kearney & Trecker have repeatedly shown that the rate of profit yield by any industry using machine tools is directly affected by the efficiency and productive capacity of its machines; and industries that fail to modernize cannot hope to compete in today's market. If more manufacturers could be educated to make machine tool replacement contingent on machine tool efficiency rather than on emergency need, many of the peaks and valleys could be leveled off.

Mr. John's proposal is an advertising program designed to show the increased profit potential that is available to users of machine tools by a more realistic approach to the matter of machinery replacement. Advertisements are directed to four distinct groups: stockholders, who are naturally interested in more returns on their investment; employes, for whom more profits mean greater security and increased volume; management, interested because of their responsibilities for efficient operation; and government, because more profits mean a more constant tax income.

Other techniques to supplement advertising in technical and business publications are motion-picture films, talks by company executives, a revitalized sales training program, publicity and merchandising devices, and printed literature. In the last-mentioned category, an interesting booklet, "Yesterday's Machines — How Much Are They Costing You?" gives case histories describing how new milling machines have cut costs in fifteen basic industries, and explaining the use of the accepted methods of computing operating costs and replacement savings that can be expected when new milling machines are installed.

Testing of Jet Engines Facilitated by Television

Electronic specialists are experimenting with industrial television to test powerful gas-turbine engines and their components at Pratt & Whitney Aircraft, Division of United Aircraft Corporation, East Hartford, Conn. Soon it may be possible for a test stand operator, from his control panel outside the test cell, to view an engine from every angle.

At present, engines under test are viewed from the control room through double glass panels, and it is practically impossible to examine more than a small part of the engine at any one time. With television, permanent records of various tests can be obtained by focussing a motion picture camera on the screen of the receiver.

* * *

Unique Steel Castings Movie Made at Lebanon

What is believed to be the only color motion picture devoted entirely to the manufacture of steel castings is attracting considerable attention throughout the foundry industry. It is entitled "Steel With a Thousand Qualities," and is sponsored by the Lebanon Steel Foundry, Lebanon, Pa., producer of stainless, special alloy, and carbon steel castings.

Since its issue a few months ago, the film has been seen in this country by more than 50,000 persons, including scores of steel experts from Asia, Europe, and South America. Negotiations are now under way for the Economic Cooperation Administration to show the film to industrial groups in various foreign countries.

The theme is based on a tour of Lebanon's facilities. Production sequences are shown for carbon-steel and alloy-steel castings, from blueprints to the completion of X-ray tests beneath a million-volt machine surrounded by walls 6 feet thick and lined with lead.

Operator manipulates control levers as he scans television screen in test stand control room. Picture on screen is that of a component for a gas-turbine engine being carried from a camera located inside the test cell.

Here's what the **SUNNEN** folks wrote us recently about their Sidney Lathes:

TELEPHONE: STERLING 2100

SUNNEN PRODUCTS COMPANY

Automotive Service Equipment · Precision Honing Machines

7910 MANCHESTER AVENUE, ST. LOUIS 17, MISSOURI

Our 16" Sidney has proved to be everything Sidney said it would be.

We have made many odd shaped dies and it will duplicate as accurately as a master part or template.

The Sidney is also easy to operate, the height is just right and all levers are conveniently located.

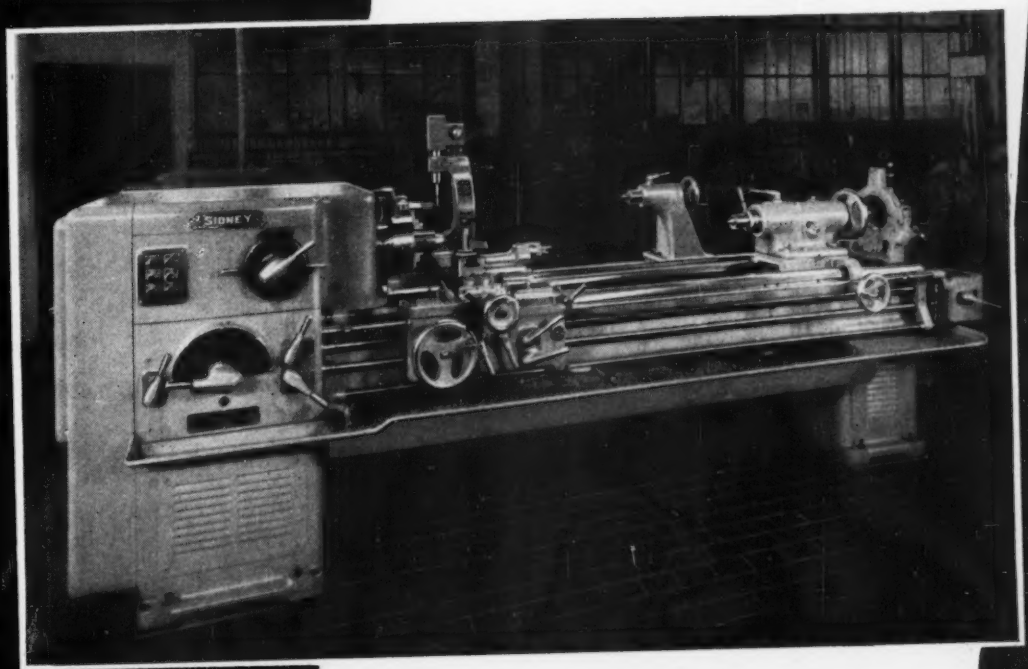
It is a real pleasure to operate a Sidney.

Cordially,

SUNNEN PRODUCTS COMPANY

George Maechling

George Maechling
Tool Room Foreman



SIDNEY FLUID TRACER LATHES

For you . . . as well as for Sunnen Products Company of St. Louis and scores of other leading makers of precision equipment . . . Sidney Lathes can do a terrific job . . . ECONOMICALLY!

The sensitive tracer head transfers every change in contour from any master piece or template to the cutting tool. A separate control switch turns off the tracer motor while the machine is performing standard lathe work.

WRITE FOR BULLETINS

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

NO BETTER
BLADES OR BANDS
Starrett®
You can't buy better hacksaws, band saws or band knives than STARRETT. They're precision made by the "World's Greatest Toolmakers" in a new streamlined plant to give you a lot more clean, fast, trouble-free cutting. By simply specifying STARRETT blades or bands you can count on better, faster production —less cost—less time out for blade changing . . . whether you cut, saw or slice.
STARRETT
FAST-KUT
Starrett SAFE-FLEX WELDED EDGE
NO HANDIER
SOURCE OF SUPPLY
Your Industrial Distributor
Because your local industrial distributor stocks and sells the complete Starrett line, you can always count on prompt, dependable, quality service. He'll gladly suggest the one best, most economical blade or band for your cutting operations. The complete line includes hacksaws for hand or power cutting — band saws for cutting metal, wood, plastics, contour cutting, friction sawing, etc. — and band knives for cutting soft or fibrous materials.
GUIDES TO BETTER CUTTING
Write for the Starrett Hacksaw and Band Saw Catalog and Quick Reference Metal Cutting Guide. Address Dept. D
Starrett
TRADE MARK
Starrett
REG U.S PAT OFF
STARRETT TOOLS
SINCE 1880
WORLD'S GREATEST TOOLMAKERS
THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.
MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES
Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

WEIGHT (IN POUNDS) OF BLUE-TEMPERED SPRING STEEL, PER LINEAL FOOT—3

Width Inches	Thickness, Inch															
	0.033	0.034	0.035	0.036	0.037	0.038	0.039	0.040	0.041	0.042	0.043	0.044	0.045	0.046	0.047	0.048
1/8	0.014	0.0144	0.0148	0.0152	0.0157	0.0161	0.0165	0.017	0.0174	0.018	0.0183	0.0186	0.019	0.0195	0.0199	0.0203
1/4	0.028	0.0288	0.0296	0.0304	0.0314	0.0322	0.0330	0.034	0.0348	0.036	0.0366	0.0372	0.038	0.039	0.0398	0.0406
3/8	0.042	0.0432	0.0444	0.0456	0.0471	0.0483	0.0495	0.051	0.0522	0.054	0.0549	0.0558	0.057	0.0585	0.0597	0.0609
1/2	0.056	0.0576	0.0592	0.0608	0.0628	0.0644	0.066	0.068	0.0696	0.072	0.0732	0.0744	0.076	0.078	0.0796	0.0812
5/8	0.070	0.072	0.0740	0.076	0.0785	0.0805	0.0825	0.085	0.087	0.090	0.0915	0.093	0.095	0.0975	0.0995	0.1015
3/4	0.084	0.0864	0.0888	0.0912	0.0942	0.0966	0.099	0.102	0.1044	0.108	0.1098	0.1116	0.114	0.117	0.1194	0.1218
7/8	0.098	0.1008	0.1036	0.1064	0.1099	0.1127	0.1155	0.119	0.1218	0.126	0.1281	0.1302	0.133	0.1365	0.1393	0.1421
1	0.112	0.1153	0.1188	0.1223	0.1256	0.129	0.1325	0.136	0.1393	0.144	0.146	0.1493	0.1526	0.156	0.1595	0.163
1 1/8	0.126	0.1297	0.1336	0.1375	0.1413	0.1451	0.149	0.153	0.1567	0.162	0.1643	0.1679	0.1716	0.1755	0.1794	0.1833
1 1/4	0.140	0.1441	0.1484	0.1527	0.1570	0.1612	0.1655	0.170	0.1741	0.180	0.1826	0.1865	0.1906	0.1950	0.1993	0.2036
1 3/8	0.154	0.1585	0.1632	0.1679	0.1727	0.1773	0.1820	0.187	0.1915	0.198	0.2009	0.2051	0.2096	0.2145	0.2192	0.2239
1 1/2	0.168	0.1729	0.1780	0.1831	0.1884	0.1934	0.1985	0.204	0.2089	0.216	0.2192	0.2237	0.2281	0.234	0.2391	0.2442
2	0.224	0.2306	0.2376	0.2446	0.2512	0.254	0.2650	0.272	0.2786	0.288	0.292	0.2986	0.3052	0.312	0.319	0.326
3	0.336	0.3459	0.3564	0.3669	0.3768	0.387	0.3975	0.408	0.4179	0.432	0.438	0.4479	0.4578	0.468	0.4785	0.489
4	0.448	0.4612	0.4752	0.4892	0.5024	0.516	0.530	0.544	0.5572	0.576	0.584	0.5972	0.6104	0.624	0.638	0.652
5	0.560	0.5765	0.5940	0.6115	0.6280	0.645	0.6625	0.680	0.6965	0.720	0.730	0.7465	0.763	0.780	0.7975	0.815
6	0.672	0.692	0.713	0.734	0.754	0.774	0.795	0.816	0.836	0.856	0.876	0.896	0.916	0.936	0.957	0.978

WEIGHT (IN POUNDS) OF BLUE-TEMPERED SPRING STEEL, PER LINEAL FOOT—4

Width Inches	Thickness, Inch															
	0.049	0.050	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.058	0.059	0.060	0.061	0.062	0.063	0.064
1/8	0.0207	0.0212	0.0216	0.022	0.0224	0.0229	0.0233	0.0237	0.0241	0.0246	0.025	0.0254	0.0258	0.0263	0.0267	0.0271
1/4	0.0414	0.0424	0.0432	0.044	0.0448	0.0458	0.0466	0.0474	0.0482	0.0492	0.050	0.0508	0.0516	0.0526	0.0534	0.0542
3/8	0.0621	0.0636	0.0648	0.066	0.0672	0.0687	0.0699	0.0711	0.0723	0.0738	0.075	0.0762	0.0774	0.0789	0.0801	0.0813
1/2	0.0828	0.0848	0.0864	0.088	0.0896	0.0916	0.0932	0.0948	0.0964	0.0984	0.100	0.1016	0.1032	0.1052	0.1068	0.1084
5/8	0.1035	0.106	0.108	0.110	0.112	0.1145	0.1165	0.1185	0.1205	0.123	0.125	0.127	0.129	0.1315	0.1335	0.1355
3/4	0.1242	0.1272	0.1296	0.132	0.1344	0.1374	0.1398	0.1422	0.1446	0.1476	0.150	0.1524	0.1548	0.1578	0.1602	0.1626
7/8	0.1449	0.1484	0.1512	0.154	0.1568	0.1603	0.1631	0.1659	0.1687	0.1722	0.175	0.1778	0.1806	0.1841	0.1869	0.1897
1	0.1663	0.1696	0.173	0.1763	0.1798	0.1833	0.1866	0.190	0.1935	0.1968	0.2001	0.2036	0.207	0.2105	0.2138	0.2171
1 1/8	0.1870	0.1908	0.1946	0.1983	0.2022	0.2062	0.2099	0.2137	0.2176	0.2211	0.2251	0.229	0.2328	0.2368	0.2405	0.2442
1 1/4	0.2077	0.2120	0.2192	0.2203	0.2246	0.2291	0.2332	0.2374	0.2417	0.2457	0.2501	0.2544	0.2586	0.2631	0.2672	0.2713
1 3/8	0.2284	0.2332	0.2378	0.2423	0.2470	0.2520	0.2565	0.2611	0.2658	0.2703	0.2751	0.2798	0.2844	0.2894	0.2939	0.2984
1 1/2	0.2491	0.2544	0.2594	0.2643	0.2694	0.2749	0.2798	0.2848	0.2899	0.2949	0.3001	0.3052	0.3102	0.3157	0.3226	0.3255
2	0.3326	0.3392	0.346	0.3526	0.3596	0.3666	0.3732	0.380	0.387	0.3936	0.4002	0.4072	0.414	0.421	0.4276	0.4342
3	0.4989	0.5088	0.519	0.5289	0.5394	0.5499	0.5598	0.570	0.5805	0.5904	0.6003	0.6108	0.621	0.6315	0.6414	0.6513
4	0.6652	0.6784	0.692	0.7052	0.7192	0.7532	0.7464	0.760	0.774	0.7872	0.8004	0.8144	0.828	0.842	0.8552	0.8684
5	0.8315	0.843	0.865	0.8815	0.899	0.9165	0.933	0.950	0.9675	0.984	1.000	1.018	1.035	1.052	1.069	1.085
6	0.998	1.018	1.038	1.058	1.079	1.100	1.120	1.140	1.161	1.181	1.201	1.222	1.242	1.263	1.283	1.303

New!

VERTICAL PRECISION BORING MACHINE BY EX-CELL-O

The new Ex-Cell-O Style 425-A Vertical Precision Boring Machine

A Flexible, Automatic Machine for Precision Boring, Turning, Facing

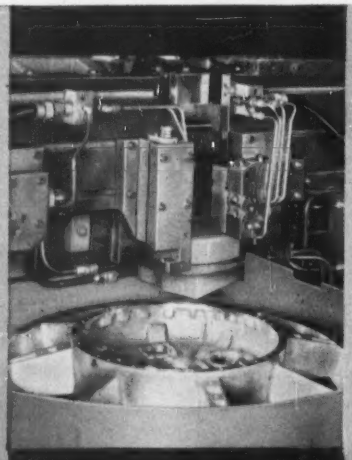
Developed by Ex-Cell-O, this standard Style 425-A Vertical Precision Boring Machine is massive and versatile. It has a heavy-duty, high-speed work spindle and rigid tool slides for close-tolerance work with a fine surface finish. It's designed for accurate production work on large parts.

The heavy cast base supports a column on which two vertical slides are mounted, each carrying a cross slide. Slides are operated by large hydraulic cylinders and move on hardened and ground steel ways. Vertical slides are fully counterweighted. All these features mean smoother operation.

The large work spindle supports a 36-inch diameter table having T-slots for mounting fixtures. The table is driven through a precision worm at variable speeds up to 500 rpm.

The machining cycle is completely automatic, including movements of vertical and cross slides, changes in work speeds, flow of coolant, and lubrication.

For more information and complete specifications on this new machine call in your Ex-Cell-O representative or contact Ex-Cell-O in Detroit today.



Close-up view of a Style 425-A equipped for operations on a jet compressor frame. Tools in the left slide face 2 surfaces, turn one diameter and chamfer one edge. The right-hand slide carries tools for feed-facing, precision boring and chamfering.

12 Features OF EX-CELL-O'S NEW MACHINE:

- Massive, Rigid Construction
- Easy Loading and Unloading
- Variable Speeds to 500 RPM
- Counterweighted Slides
- Large Hydraulic Cylinders
- Hardened and Ground Ways
- Flexible Automatic Cycles
- Automatic Speed Changes
- Automatic Coolant Control
- Automatic Lubrication
- Conforms to J.I.C. Standards
- Skilled Operator Unnecessary

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

News OF THE INDUSTRY

California and Texas

HARRY P. SMITH, JR., was recently appointed executive vice-president and general manager of operations by the Hufford Machine Works, Inc., El Segundo, Calif. Mr. Smith has been with the company since its organization in 1942, and was sales manager at the time of his appointment. WALTER G. WHEELER, chief engineer of Hufford, has been promoted to the position of vice-president in charge of engineering and production, while KINGSLEY DRONE succeeds Mr. Wheeler as chief engineer. WILLIAM KAHLER has been made plant superintendent.

STANDARD PRESSED STEEL CO., Jenkintown, Pa., announces the acquisition of COOPER PRECISION PRODUCTS, 5625 W. Century Blvd., Los Angeles, Calif., manufacturer of hex-head bolts for the aircraft industry. HARRY S. COOPER will remain as president of Cooper Precision Products. ALBERT A. LEEDOM, manager of tooling and quality for the Standard Pressed Steel Co., has been transferred to the Los Angeles management staff.

HARVEY V. EASTLING, who was general sales manager for the Pacific Division of the Link-Belt Co., Chicago, Ill., with headquarters at San Francisco, Calif., has been named assistant general manager of that division. DONALD E. THAL, assistant sales manager, has been promoted to sales manager of the San Francisco plant.

CARPENTER STEEL CO., Reading, Pa., recently opened a new mill-branch warehouse and office at 1530 Industrial Way, Belmont, Calif., and celebrated the occasion with an open house. D. J. O'NEIL, Pacific Coast manager for the company, is in charge of the Belmont office, while M. J. BROWN and K. C. LARGENT are salesmen with headquarters there.

WILLIS L. WINTER has been named distribution apparatus manager of the Pacific Coast district by the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Winter, whose headquarters are in San Francisco, Calif., has been assistant to the manager of the electric utility department in this district.

ADAMAS CARBIDE CORPORATION, Harrison, N. J., manufacturer of standard carbide tools, tool tips, dies, and wear parts, announces the appointment of the SPECIFAX CORPORATION as sales representative in California. The Specifax concern is located at 555 E. Walnut St., Pasadena, Calif.

HOWARD A. SMALL has been named cutting tool and gage sales engineer in the Los Angeles, Calif., territory of Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Mr. Small will have his headquarters at 2675 Santa Fe Ave., Los Angeles.

NICK S. DEANOVICH has become Texas representative of the Gisholt Machine Co., Madison, Wis. Mr. Deanovich, who has been with the company for nearly fifteen years, will be located at 4101 San Jacinto, Houston, Tex.

Illinois and Indiana

NATIONAL FLUID POWER ASSOCIATION was recently organized at a meeting of forty-five companies in the fluid power industry held at Bedford, Pa. The following officers were elected: Chairman, JOHN C. HANNA, vice-president, Hanna Engineering Works; first vice-chairman, B. N. ASHTON, president, Electrol, Inc.; second vice-chairman, JOHN E. ERSKINE, vice-president, Racine Hydraulic & Machinery, Inc.; and treasurer, E. G. PETERSON, president, Hannifin Corporation. COLONEL BARRETT ROGERS, industrial management consultant, was appointed executive secretary of the Association, whose headquarters have been established at 1618 Orrington Ave., Evanston, Ill.

John C. Hanna, chairman of the newly organized National Fluid Power Association

MICROMATIC HONE CORPORATION, Detroit, Mich., has announced the acquisition of the DIESEL ENGINEERING & MFG. CORPORATION (Demco), Chicago, Ill. The latter concern was founded in 1940 by NICHOLAS FODOR, who has been engaged in Diesel engineering work since his graduation from the Royal Technical University of Budapest in 1920. Mr. Fodor has worked out techniques for manufacturing Diesel fuel-injection systems and jet fuel-flow controls which permit mass production of components within extremely close tolerances. Demco will be known in the future as MICRO-PRECISION, INC., and will be operated under the direction of Mr. Fodor as executive vice-president and general manager. The business will remain in Chicago.

WHEELCO INSTRUMENT DIVISION, BARBER-COLMAN CO., Rockford, Ill., has added the following engineers to its sales and service organization: ROBERT UNGER, service engineer, Chicago; HAROLD L. DIRKERS, sales engineer, and LEONARD V. BLOOM, service engineer, Detroit; WILLIAM E. KING, service engineer, New York; LAWRENCE S. HOLBROOK, service engineer, and ROBERT HEMMAN, sales engineer, Boston; SCOTT R. BABCOCK, service engineer, and CLYDE PERSON, service engineer, Rockford.

FRANKE GEAR WORKS, Chicago, Ill., announces the incorporation of the company, and will be known as FRANKE GEAR WORKS, INC. WILLIAM F. FRANKE, founder of the company, is retiring from activity with the firm but will remain on the board of directors. CARL T. FRANKE is now president; V. A. TINAGLIA, vice-president and sales manager; and JOSEPH W. TINAGLIA, JR., assistant to the president in charge of manufacturing and engineering.

THOR POWER TOOL CO., Aurora, Ill., announces the election of the following vice-presidents: J. A. HILL, vice-president and sales man-

ager; JOHN A. MCGUIRE, who is chairman of the executive committee, vice-president in charge of labor relations; B. H. JOHNS, vice-president in charge of rock drill sales; and W. B. HUNN, vice-president in charge of the company's Los Angeles, Calif., works.

FIRTH STERLING, INC., Pittsburgh, Pa., announces the establishment of a new Chicago district office and warehouse at 3415 North Ave., Melrose Park, Ill. The former warehouse was located in Chicago. R. O. VALOON, who has been with the company for nineteen years, has been appointed manager of the Chicago district, replacing E. A. CARPENTER, who has resigned.

CHARLES R. VAN RIPER, who has been with the Norton Co., Worcester, Mass., since 1929, is being made district sales engineer in the Chicago, Ill., district, where he will organize and direct field engineering activities. Mr. Van Riper has been in the company's research and development department since 1941, most recently as a field engineer.

WALTER E. GUNNERSON, sales manager and chief engineer of the Anderson Bros. Mfg. Co., Rockford, Ill., manufacturer of hydraulic hand and power presses, has been elected vice-president in charge of sales, a newly created position. Mr. Gunnerson has been with the company for twenty-seven years.

EDWIN W. SHIPMAN has been elected vice-president and manager of the Licensee Division of the Illinois Tool Works, Chicago, Ill. Mr. Shipman has been with the Illinois Tool Works for more than twenty-five years, and has been connected with the company's licensee activities since 1939.

Edwin W. Shipman, who is now vice-president of the Illinois Tool Works

AMERICAN MACHINE & FOUNDRY CO., New York City, is opening a branch office at 520 N. Dearborn St., Chicago, Ill., thus grouping in one building the sales offices for the greater Chicago area of several company divisions and subsidiaries.

CINCINNATI METALCRAFTS, INC., Cincinnati, Ohio, announces the sale of its Sebastian Lathe Division to the SHELDON MACHINE CO., Chicago, Ill. All manufacturing operations are being moved to the Chicago plant of the Sheldon Machine Co.

JAMES R. RUSSELL has been named secretary of the Illinois Tool Works, Chicago, Ill. At the time of his appointment, Mr. Russell was assistant treasurer of the company, a position he will continue to hold.

DELTA TANK MFG. CO., INC., Baton Rouge, La., manufacturer of containers for liquefied petroleum gas, is building its third manufacturing plant, this one at Beardstown, Ill.

DAVID MACGREGOR, chief engineer of Edward Valves, Inc., East Chicago, Ind., subsidiary of the Rockwell Mfg. Co., Pittsburgh, Pa., has been assigned the additional duties of works manager.

Michigan

SHEAR-SPEED CHEMICAL PRODUCTS DIVISION OF MICHIGAN TOOL CO., Detroit, Mich., announces the appointment of the following representatives: For southern Ohio and Kentucky—E. W. BROCK, 5657 Montgomery Road, Cincinnati 13, Ohio; southern Illinois, Missouri, and eastern Kansas—H. O. MONOHAN, 1007 Yale Ave., St. Louis 17, Mo.; Wisconsin—C. B. PARSONS CO., 739 N. Broadway Ave., Milwaukee 2, Wis.; northern Illinois and eastern Iowa—POLHEMUS-MILLER CO., 9 S. Kedzie Ave., Chicago 12, Ill.; and east-central Indiana, D. C. WEDLICK, 401 Willow Lane, Muncie, Ind.

ELECTRO ARC SALES CO. has been formed to handle metal disintegrators made by the Electro Arc Mfg. Co. T. J. O'CONNOR is president and manager of the sales organization, whose headquarters are 5270 Geddes Road, Ann Arbor, Mich. Also announced was the appointment of HARWOOD L. BROWN as factory sales engineer in Ohio. His headquarters will be at the Ann Arbor address.

JOHN F. HALLER has been elected vice-president in charge of engineering for the Allied Products Corporation, Detroit, Mich. Mr. Haller was the founder and president of the Michigan Powdered Metal Products Co., Inc., until it

John F. Haller, newly elected vice-president in charge of engineering of the Allied Products Corporation

was acquired by the Allied Products Corporation in 1951, becoming a subsidiary. In addition to his engineering research work on the Allied staff, he will continue to direct the development work of the subsidiary. EUGENE F. WAMBOLD has been made vice-president and general manager of the Michigan Powdered Metal Products Co., Inc., Northville, Mich. He was formerly vice-president in charge of manufacturing at the Carboloy Department of the General Electric Co.

Dr. WILLIAM R. VEAZEY, long identified with research and administrative activities of the Dow Chemical Co., Midland, Mich., has retired after thirty-seven years of service. Also announced was the appointment of three new vice-presidents: DR. RAY H. BOUNDY, director of research; DONALD WILLIAMS, director of sales; and DR. J. D. HANAWALT, manager of the magnesium department.

KOHN ENGINEERING CORPORATION, Detroit, Mich., announces its removal to a plant located at 8830 S. Telegraph Road, Taylor Center, Mich. The new plant, which has approximately 12,000 square feet of space, will be used for the manufacture and assembly of screw machine products for the automotive, aircraft, and electrical fields.

WILLIAM B. CRUMP has joined May-Fran Engineering, Inc., Cleveland, Ohio, as sales engineer in charge of the Detroit, Mich., office of the company.

GARLOCK PACKING CO., Palmyra, N. Y., announces the removal of its Detroit, Mich., office to 2781 E. Grand Blvd.

Special

REVERE MILL TECHNIQUES

serve American Sanitary

Shown here are a few of the more than a thousand of American Sanitary plumbing goods made largely of Revere brass plumbers' tube. This tube is made by special techniques developed by the Revere Mills to assure easy fabrication into plumbers' items.

Almost every home in this great country of ours has plumbing. Most people never give a second thought to traps and bends and elbows, sink strainers, flanges and so on. But both Revere and American Sanitary Manufacturing Co., Abingdon, Illinois, think a lot about them. American Sanitary makes over a thousand such items for plumbing, and buys a great deal of Revere brass plumbers' tube, also hexagonal O.D., round I.D. heavy wall leaded brass tube for easy machining into fittings. The point about this long association between Revere and American Sanitary is that Revere uses special mill techniques to produce brass plumbers' tube. These techniques make it possible for American Sanitary to produce the bends, often at 180°, without cracking, without marring the finish. Thus nickel or chromium plating can be carried out successfully, and beautiful parts produced, the parts that householders admire, and which add to the value of both new and older houses. Thus, behind even the most taken-for-granted articles there is usually a lot of special skill and know-how.... If you would like to benefit from the capabilities of the Revere Mills, and of the Revere Technical Advisory Service, get in touch with the nearest Revere Sales Office. See your telephone directory, or write direct.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

New England

AMERICAN MACHINE & FOUNDRY Co., New York City, has opened a development engineering laboratory in Greenwich, Conn., in order to expand the design and development activities of its Engineering Division. H. A. OLDENKAMP will serve as director, and R. A. KIMES as manager, of the laboratory. They were formerly chief engineer and assistant chief engineer, respectively, in the company's Brooklyn plant.

EDWIN S. HANNY was recently appointed Connecticut and western Massachusetts field representative for the Alloy Precision Castings Co., Cleveland, Ohio. Mr. Hanny has established an office at 166 Trumbull Ave., Plainville, Conn.

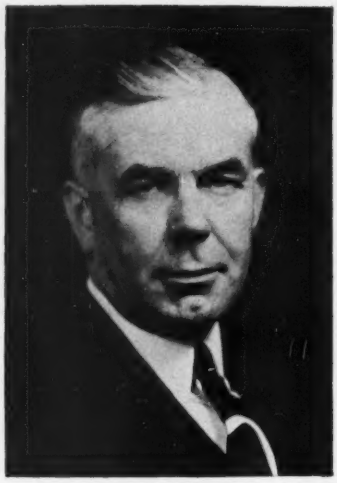
ENTHONE, INC., New Haven, Conn., manufacturer of chemicals for the metal-finishing industry, announces the completion of a new building at New Haven, thus adding 6600 square feet to its facilities.

FOXBORO CO., Foxboro, Mass., manufacturer of industrial instruments for measuring and control, has announced the organization of a Mexican affiliate, GRAFICAS e INSTRUMENTOS, S. A., Mexico City. The new firm has been incorporated for the future manufacture and assembly of instruments and instrument supplies.

JEROME OTTMAR, manager of engineering and sales in the General Plate Division of the Metals & Controls Corporation, Attleboro, Mass., has been made vice-president. Mr. Ottmar is also sales promotion manager for the Spencer Thermostat Division of the corporation.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., announces that the New England and eastern apparatus sales districts have been integrated into a northeastern region. Manager of this combined district will be ROBIN S. KERSH, who was elected a vice-president in April. Mr. Kersh will also hold the position of manager of the eastern district. His previous position was executive vice-president of the Westinghouse International Co. EDWARD C. DELANO will remain as manager of the New England district.

K. HAZEN WOOLSON, president of the Jones & Lamson Machine Co., Springfield, Vt., recently resigned from this office, after having served the company for thirty-three years. Mr. Woolson became president of the company in 1946. He will continue to act as a director, and has been appointed vice-chairman of the board. HARDAGE L. ANDREWS has been named successor to Mr. Woolson. Mr. Andrews was associated



Hardage L. Andrews, president of Jones & Lamson Machine Co.

with the General Electric Co., Schenectady, N. Y., from the period of his graduation from the University of Missouri to his retirement in 1951 from G-E. In 1934, he was made a vice-president in charge of all railroad electrification and transportation of the company. Five years later, he was placed in charge of the appliance and merchandise department, with headquarters in Bridgeport, Conn. In 1950, he was elected executive vice-president, assuming charge of the industrial products and lamp group.

GORDON W. SMITHSON has been promoted to the position of chief engineer of the Potter & Johnston Co., a subsidiary of Pratt & Whitney Division Niles-Bement-Pond Co., Pawtucket, R. I. Mr. Smithson has been with the company for seventeen years. In his new position, he will direct all product improvement and engineering and research, both mechanical and electrical, on Potter & Johnston machine tools.

Gordon W. Smithson, chief engineer of the Potter & Johnston Co.

New York and New Jersey

CARBORUNDUM CO., Niagara Falls, N. Y., recently announced the following retirements in the Industrial Abrasive Sales Division: GEORGE S. ROGERS, Buffalo, N. Y., district sales manager with thirty-seven years of service; WILLIAM T. O'MARA, general salesman, Buffalo sales district, with forty-one years of service; and SAMUEL PHIPPS, general salesman, St. Louis, Mo., district with thirty-five years of service. Also announced were the following promotions: GEORGE H. DENNISON has moved up from assistant to district sales manager, Buffalo; WILLIAM G. KETTNER, JR., from assistant to office manager, New York sales district; and M. I. JOHNSON, formerly bonded field sales engineer in the Buffalo district, has been made general salesman of that district. The following men were transferred: C. R. STRONG, a general salesman in the Chicago district servicing Wisconsin, was transferred to Peoria, Ill., while F. H. GARSKE, JR., A. G. OTT, and J. H. SPEHR will service the Wisconsin territory formerly handled by Mr. Strong. G. A. TANNER was made a general salesman assigned to the St. Louis district formerly covered by Mr. Phipps; H. A. JOHNSON, who was a coated abrasive salesman in St. Louis, was assigned to the south Texas coated abrasive territory formerly serviced by S. E. H. FRANCE, who was transferred to the New York sales district; H. W. MCGARR, formerly a coated abrasive salesman for the Des Moines-Davenport, Iowa, territory, was transferred to the Chicago district, while R. D. HULBEN and Mr. Strong will handle the territory previously serviced by Mr. McGarr.

E. C. CLARK, assistant director of the research and engineering department of the Air Reduction Sales Co., New York City, has been appointed director of operations. Mr. Clark, who has been with the company for twenty-four years, has held various positions during this period, including that of manager of gas plants. L. B. DOBBINS, who was works manager of Airco's liquid oxygen plant at Butler, Pa., has been named manager of plant engineering in New York City. Mr. Dobbins is replacing R. E. LENHARD, who has been transferred to the company's Ohio Chemical and Surgical Equipment Division at Madison, Wis., assuming the position of vice-president of manufacturing.

TO
GEAR MANUFACTURERS
Exclusively

if you have trouble meeting production schedules.

if you have trouble meeting precision tolerance specifications.

YOU should "read-up" on the HAMILTON® line of Small-Gear, Precision Hobbing Machines!

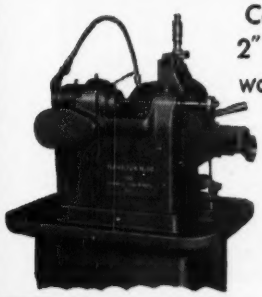
3

THREE *PRECISION* MACHINES to meet your every requirement.

HAMILTON No. 00

For the generation of spur gears and pinions only.

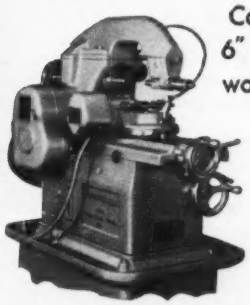
Capacity: 2" O.D. of workpiece.



HAMILTON No. 1

Hobs spur and spiral gears, worm gears and worms (to three thread), splined shafts, gear sectors, and pinions.

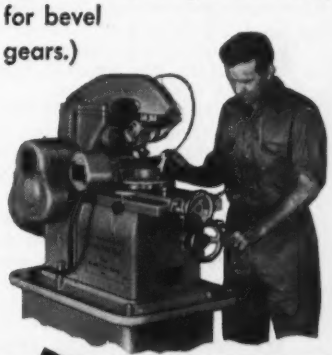
Capacity: 6" O.D. of workpiece.



HAMILTON No. 1-B

Generates any shape that can be made on the No. 00 or the No. 1 machines, *plus* bevel gears and face gears.

Capacity: 6" O.D. of workpiece (3" O.D. by 3/16" face, for bevel gears.)



Exclusive Greater range of hob spindle speeds: 109 to 1259 R.P.M. — 12 speeds.

Exclusive Speed, feed, indexing. *Each can be selected independently.* This, and wide range of hob speeds, adds flexibility; reduces set-up time; gives quick selection of speed and feed to suit material and gear size.

Exclusive Alignment and trueness of work and hob spindles are held to within .0002".

Exclusive Generates gears from 3 teeth to 1200 teeth.

Exclusive Accumulative error of not more than .0002" guaranteed.

THE COMPLETE STORY will be sent to you free for the asking. Request **BULLETIN GH-5310** DO IT NOW!

THE *Hamilton* TOOL COMPANY
838 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

George C. Miller, the new president of Bakelite Co., a Division of Union Carbide and Carbon Corporation

GEORGE C. MILLER has been appointed president of the Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City, succeeding H. S. BUNN. Mr. Bunn, who is vice-president of Union Carbide, replaces the late J. W. McLaughlin as chairman of Bakelite. Mr. Miller was employed by the Linde Air Products Co., another Division of Union Carbide, in 1922, and several years later was transferred to the plastics dapartment of the Carbide and Carbon Chemicals Co. In 1945, he became vice-president and general sales manager of the Bakelite Co., and last year, vice-president in charge of sales.

LAKE ERIE ENGINEERING CORPORATION, Buffalo, N. Y., manufacturer of hydraulic presses and special machinery, has announced the establishment of the Rolling Mill and Special Products Division for the supply of a broad line of auxiliary rolling mill equipment for ferrous and non-ferrous metals. The Division will be under the direction of J. P. FINKBONE, who recently joined the concern. Mr. Finkbone was formerly executive vice-president of the Arms-Franklin Corporation, Youngstown, Ohio.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the following appointments in the newly established Empire District of the Apparatus Sales Division, Syracuse, N. Y.: R. A. OSBORNE, manager of sales; H. C. LINDBERG, manager of engineering; E. H. AUSSICKER, manager of apparatus and component product sales; W. A. BISER, manager of agency and distributor sales; and B. J. FIRKINS, manager of advertising and sales promotion. Also announced was the appointment of W. F. RAUBER as manager of the Buffalo, N. Y., office and J. D. HERSHEY, as manager of the Rochester, N. Y., office.

AIR REDUCTION CO., INC., New York City, announces the following research and engineering department changes: DR. L. I. GILBERTSON, formerly administrative manager at the Murray Hill, N. J., laboratories, has been appointed director there; DR. G. B. CARPENTER, who was manager of the chemical division at Murray Hill, has been named manager of the development staff with headquarters in New York City; DR. A. MULLER, manager of the Metallurgical Division, has been appointed director of metallurgical research; and DR. B. C. REDMON has joined Airco as director of chemical research. The two last-named men will be at the Murray Hill laboratories.

MICHAEL M. MUNSON has been appointed cutting tool sales engineer by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. He will devote his entire time to special application and engineering problems in the cutting tool line for concerns served by the company's New York, Rochester, and Philadelphia branch offices. Mr. Munson will make his headquarters at 117 Liberty St., New York City.

LEONARD A. KIRSH has joined Waldes Kohinoor, Inc., Long Island City, N. Y., manufacturer of Waldes Truarc retaining rings and grooving tools and Waldes slide fasteners, in the capacity of assistant to the advertising manager.

S. J. SINDEBAND, executive vice-president of the Mercast Corporation, New York City, has been advanced to the position of president. Mr. Sindeband is also president of the Alloy Precision Casting Co., Cleveland, Ohio.

JOEL HUNTER was recently elected a director and executive vice-president of the Crucible Steel Company of America, New York City. Mr. Hunter was formerly vice-president in charge of finance.

CARL H. MORKEN, works manager of the Kennedy Valve Mfg. Co., Elmira, N. Y., has been promoted to the position of vice-president in charge of manufacturing.

BERNARD ANSCHER has been named sales manager for domestic sales by HYDROPRESS, INC., New York City, and its LOEWY ROLLING MILL DIVISION.

THOR POWER TOOL CO., manufacturer of air and electric power tools, Aurora, Ill., has opened a sales and service office at 1 Tichenor Lane and Parkhurst St., Newark, N. J., to serve northern New Jersey, an area formerly covered by the company's New York branch.

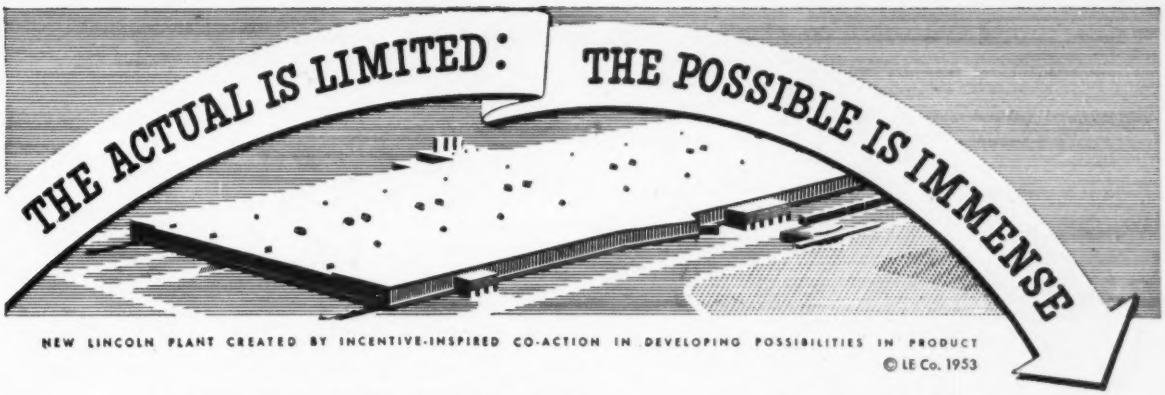
WALTER A. BAUMSTARK has been appointed midwestern regional manager of sales for the Alloy Tube Division of the Carpenter Steel Co., Union, N. J. Mr. Baumstark, who was district manager at St. Louis, Mo., will supervise sales in the Midwest.

Ohio

L. E. BROWN has been named district sales manager in Detroit, Mich., for the Reliance Division of the Eaton Mfg. Co., Massillon, Ohio. He takes the place of the late H. R. Hanna. Mr. Brown was formerly sales engineer in the Detroit territory, a post now to be filled by WILLIAM R. CHANDLER, who was formerly sales engineer in the Cleveland, Ohio, office. Also announced by the Division were the appointments of TOM L. HUNTER and WILLIAM MCCORMICK as sales engineers, the former in New York City and the latter in Cleveland. Mr. Hunter has just joined the company, while Mr. McCormick is being transferred from the Axle Division of Eaton.

W. E. BENNINGHOFF has been elected vice-president of the Ohio Crankshaft Co., Cleveland, Ohio. Mr. Benninghoff will continue as general manager of the company's Tocco Division. Another announcement made was to the effect that FOSTER H. PETTAY, vice-president, has been given the additional post of secretary-treasurer of the company. C. H. KIMMEL, vice-president and general manager of Ohio Crankshaft, has been named a director of the company, succeeding the late Francis S. Denneen.

W. E. Benninghoff, vice-president of the Ohio Crankshaft Co.



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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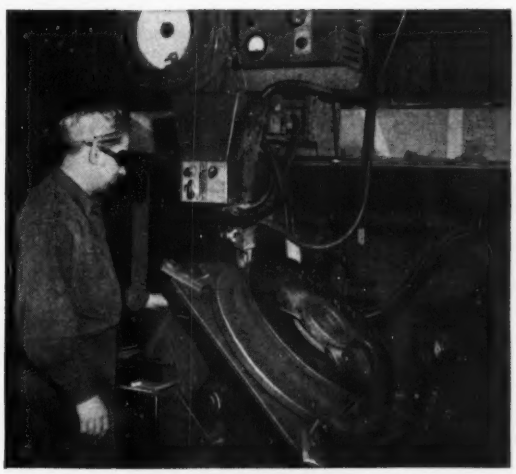
TO CUT WELDING COSTS: centralize welding responsibility with Lincoln's complete automatic service



Full Automatics—*"Automatic Lincolnweld" . . . industry's standard for fast, low cost quality "hidden-arc" welding. Available for mounting on fixtures or for tractor mounting on heavy flat work. "Twinarc" head may be quickly mounted to increase welding speeds* 50% and more *using two electrodes with same "Lincolnweld" controls.*

Semi-Automatics—*"Manual Lincolnweld," commonly known in industry as "squirt welder" . . . leader in high-current density welding. Combines fast, low cost benefits of automatic welding with flexibility of hand welding. Easy to set up . . . the "Manual Lincolnweld" gun may be mounted in simple, low cost fixtures for flat and near flat work.*

Unique Agglomerated Fluxes—Cover 30% more footage at 45% less cost. In Lincoln Agglomerated Fluxes ingredients are held together with a simple binder . . . to retain *original identity* at the time of welding. The ingredients are not lost or changed in composition. *Every grain is identical!* Furthermore, alloys can be added to produce any type of weld deposit with mild steel wire. Fluxes 760, 780 and 840 are for automatic welding. Flux H-545 is for hardsurfacing for severe impact. Flux H-550 is for severe abrasion.

Automatic Electrodes—For mild steel

- L-60 . . . mild steel wire .12 carbon
- L-61 . . . mild steel wire .12 carbon silicon killed
- L-70 . . . alloy steel wire .14 carbon plus .5% moly.
- L-201 . . . medium carbon steel wire (.55 carbon)
- L-18/8 . . . stainless steel wire

"Automatic" Engineering—Benefit from Lincoln's complete application engineering service available throughout the country. Automatic welding specialists, located in every principal industrial area, will gladly analyze your welding needs, suggest the most efficient tooling and welding procedures for lowest cost operation. Call or write

THE LINCOLN ELECTRIC COMPANY

DEPT. 1206 CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

Thomas T. Kling, newly elected vice-president and director of the Lodge & Shipley Co.

THOMAS T. KLING was recently elected vice-president and a director of the Lodge & Shipley Co., Cincinnati, Ohio, lathe manufacturer. Mr. Kling, who has been works manager for the company since 1948, will continue with his present duties. He started with the concern in 1928.

Pennsylvania

ROCKWELL MFG. CO., Pittsburgh, Pa., recently announced the formation of the Drill Unit Division for the manufacture and sale of a new air-hydraulic drill unit. The division with headquarters at the Pittsburgh plant, will be headed by RALPH CAOUETTE, general manager of the company's Register Division. E. C. WARRICK, who was chief engineer in the Delta Mfg. Division, has been promoted to chief engineer in the Power Tool Engineering Division. He succeeds PAUL E. BUTZIN, who will continue to serve as consultant for the Division.

J. F. CONNAUGHTON, formerly general manager of the Hamilton Division of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., was recently elected vice-president in charge of the Eddystone Division.

Wisconsin and Iowa

DONALD M. LAFLIN has been named vice-president in charge of sales at the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Mr. Laflin has been a member of the company for twenty years—his first assignment as eastern district sales manager and for the last three years as general sales manager. EDGAR L. MCFERREN, chief engineer for the company, has been appointed vice-president in charge of engineering. Mr. McFerren has been with Giddings & Lewis for seventeen years. Other appointments made by the company are as follows: MILTON H. NICHOLS, formerly northeastern district sales engineer, has been made export sales manager with headquarters in Paris, while DAVID F. ROBINSON, who was formerly associated with the Rudel Machinery Co., Inc., New York City, is assuming the vacancy created by Mr. Nichols' appointment; RALPH BREITUNG, secretary-treasurer; FRED C. FREUND, works manager; WILLIAM H. SORENSON, assistant to the president; and HARRY C. SOUKUP, superintendent.

(Left) Donald M. Laflin, vice-president in charge of sales at the Giddings & Lewis Machine Tool Co.; and (right) Edgar L. McFerren, vice-president in charge of engineering

M. J. FEY has been promoted to the post of executive engineer of the NICHOLS WIRE & ALUMINUM CO., Davenport, Iowa, his duties including the supervision of development and design.

Obituaries

FRANCIS S. DENNEEN, secretary-treasurer and co-founder of the Ohio Crankshaft Co., Cleveland, Ohio, died on May 10. Mr. Denneen was graduated from Purdue University in 1903, and became associated with the Ohio Brass Co. In his capacity as chief engineer there, he developed plans for the electrification of the Great Northern Railway through the Cascade tunnel and across the Cascade Mountains. In 1909, he joined the Chalmers Motors Co., where he was also chief engineer. Five years later, however, he formed his own concern, the Denneen Motor Co., later consolidating his company with the Grant Motor Corporation, of which he became general manager. In 1920, Mr. Denneen met another young engineer, William C. Dunn, and together they organized the Ohio Crankshaft Co. Until his death, Mr. Denneen retained an active daily interest in the company.

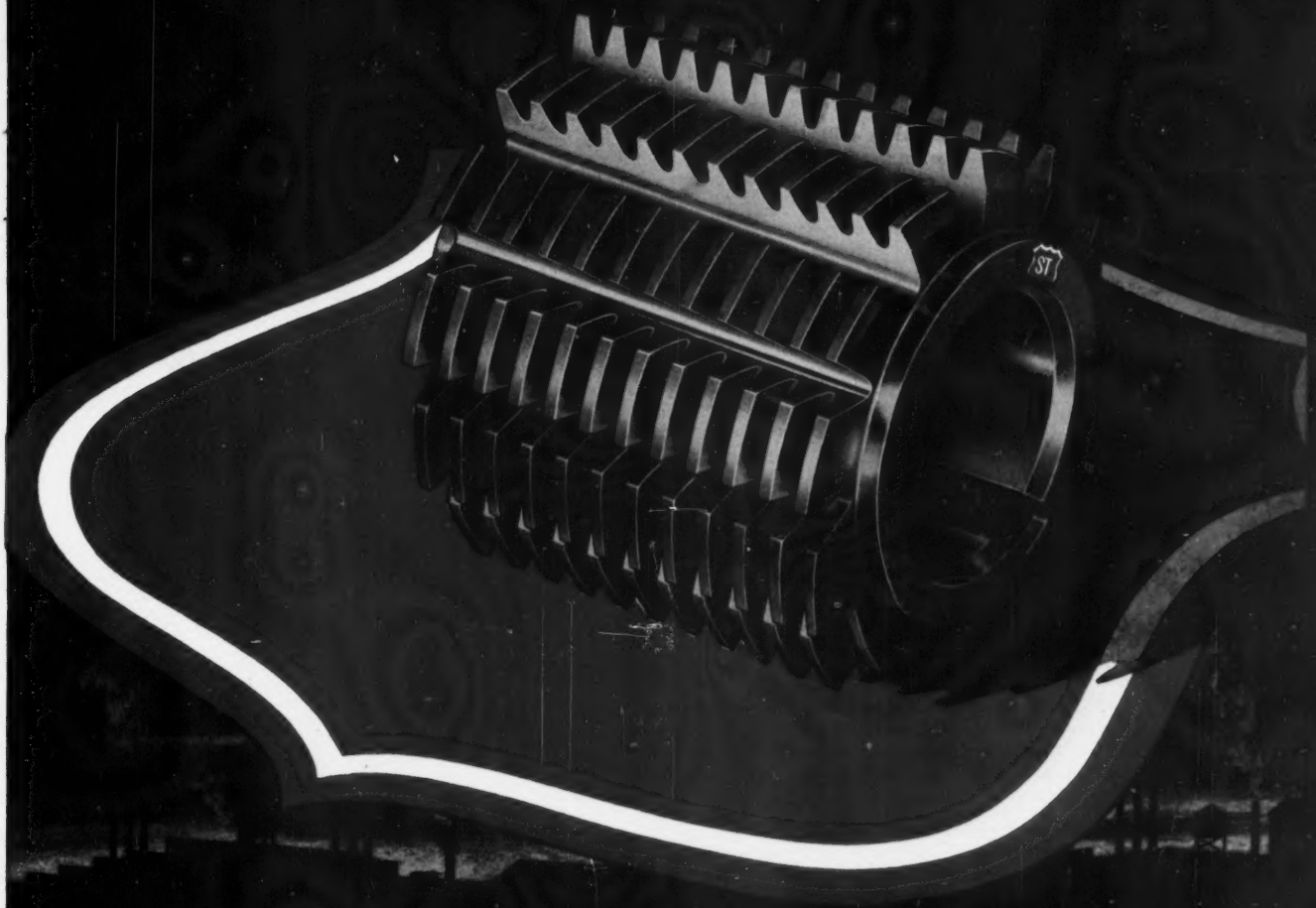
L. D. RIGDON, consultant to the manufacturing vice-president of the Westinghouse Electric Corporation, Pittsburgh, Pa., died suddenly on May 24, at his home in Pittsburgh at the age of sixty-seven years. Mr. Rigdon joined Westinghouse in 1909, serving most of the time since then in an executive capacity in connection with shop methods and equipment. During World War II, he was manager of manufacturing for the Emergency Products Division of the corporation, and later became manager of the headquarters manufacturing department. In 1951, Mr. Rigdon was appointed assistant to the vice-president in charge of manufacturing.

GEORGE C. MONTAGUE, who was the first grinding machine salesman to be employed by the Norton Co., Worcester, Mass., died on May 27 at the age of eighty-six years. Mr. Montague started selling Norton grinding wheels and grinding machines in 1898. In 1932, he was named New England district sales manager, the post he held until his retirement in 1936.

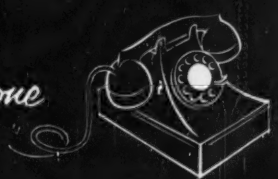
OSCAR E. SCHLICHTER, founder of the Hamilton Tool Co., Hamilton, Ohio, died on June 10 in Denver, Colo., at the age of seventy-eight years. He was a native of Germany. Mr. Schlichter was widely known in the machine tool field.

Red Shield says:

"STANDARD for tough jobs since 1881"



as near as your telephone



Call your Industrial Supply Distributor for Shield Brand Hobs. Specialized factory service available everywhere.

STANDARD TOOL CO.

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NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

SCULLY JONES Precision Holding

Squeezes every "tenth" out of each cut on 10-Station Double End Trunnion Machine

Here's how smart machine design solves tooling problems on a BARNESDRILL 10-station machine built for automotive work. BARNESDRILL engineers specified Scully-Jones *Precision Holding* Tools to preserve vital accuracy of spindles having a "long reach" . . . compensate for tool wear . . . speed set-up . . . assure a high, profitable production rate.

Scully-Jones Adjustable Adapters on drilling and reaming spindles make tool changes fast. They simplify precise depth adjustments at individual spindles after sharpening tools to new lengths. Drill and Tap Drivers permit maximum utilization of cutters . . . help eliminate runout . . . provide a positive, no-slip drive.

Guided by pilot bushings, boring, hollow-milling, facing, reaming and tapping tools are driven by Scully-Jones Floating Holders to maintain precise alignment . . . eliminate bell mouth . . . produce straight round holes . . . end "cramping" or damage to cutting teeth.

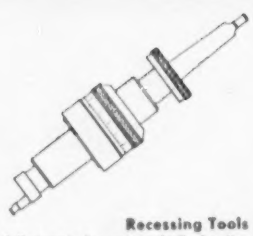
Builder or buyer—you take full advantage of critical machine and cutting tool accuracies with Scully-Jones *Precision Holding* and driving tools. Ask your Scully-Jones representative or stocking distributor, today!

Scully-Jones Quick-Lock Adjustable Adapters are used on each of 11 spindles in auxiliary head.

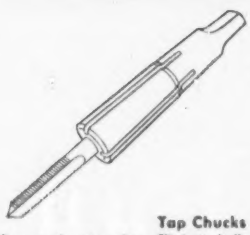
QUICK-LOCK ADJUSTABLE ADAPTERS on multiple drilling, tapping and reaming spindles give you maximum flexibility of set-up. Pilot nose minimizes tendency of adapters to bind or jam. Tool changes are fast. Spindle adjustments are easy to make.

ACCURATE FIT assured by National Acme thread. Top face of nut is square within .002" to .003", holds original accuracy of spindle when locked in place. Fine-increment adjustments permit setting to precise depth. Small diameter permits close-center work. Wide range of standard sizes for most multiple-spindle tools.

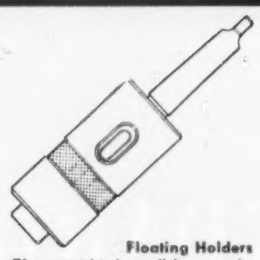
THERE'S A SCULLY-JONES PRECISION TOOL FOR EVERY HOLDING AND DRIVING NEED . . .



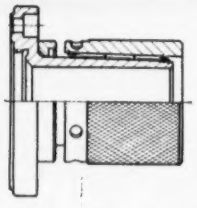
Recessing Tools
Adjustments for automatically locating and controlling depth of groove are precise and fast. Rapid cutting cycle.



Tap Chucks
Save costly set-up time. Eliminate bell-mouthed and oversized tapped holes. True collet action on shank of tap.

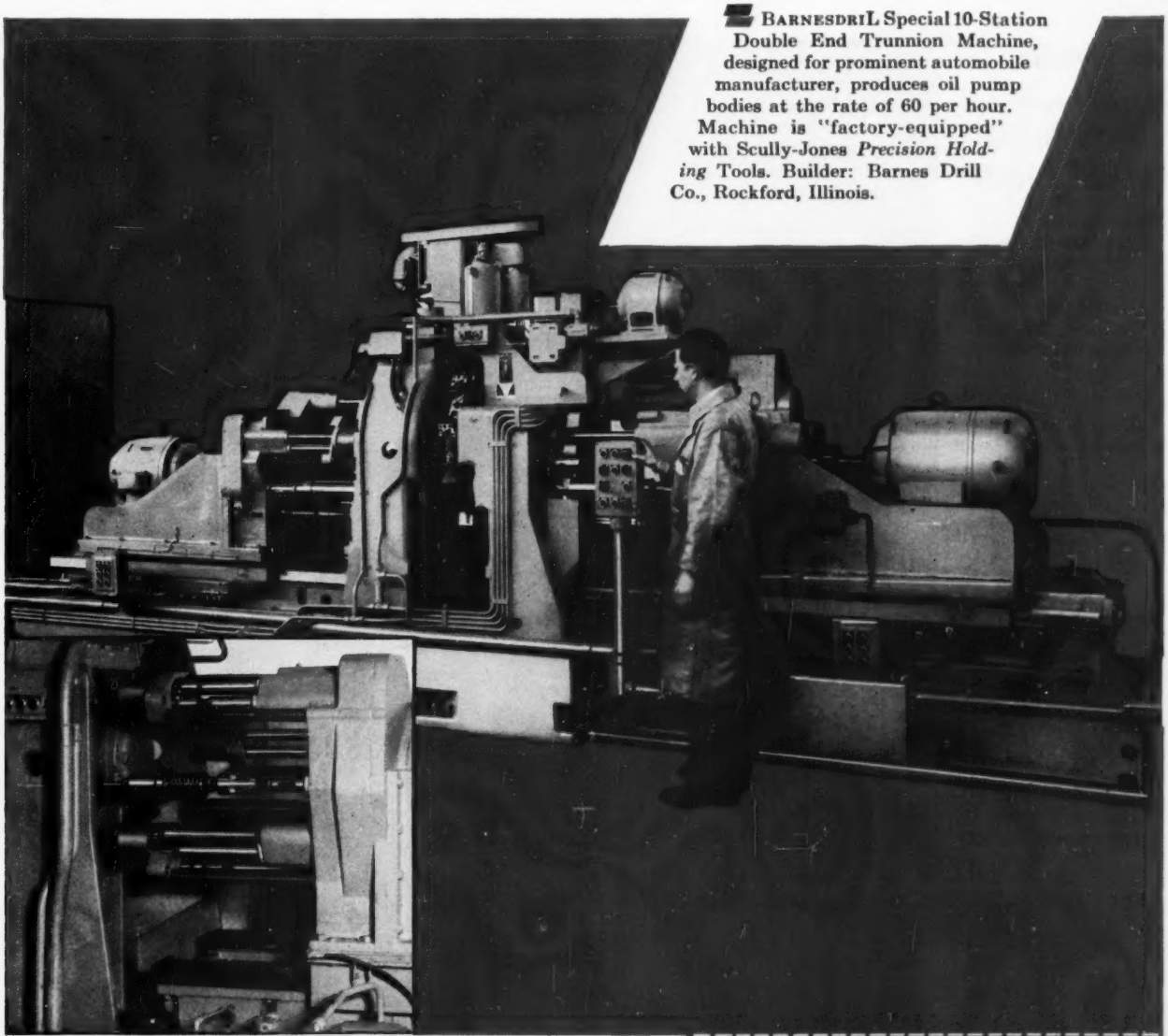


Floating Holders
Give unrestricted parallel or angular float. Reduce scrap and tool breakage caused by misalignment of tool with work.



"Roll-Lock" Chucking Tools
New method of creating accurate, centering shrink fit to hold on outside or inside diameter of work or tool.

helps build BARNESDRIL *accuracy*



BARNESDRIL Special 10-Station Double End Trunnion Machine, designed for prominent automobile manufacturer, produces oil pump bodies at the rate of 60 per hour. Machine is "factory-equipped" with Scully-Jones *Precision Holding* Tools. Builder: Barnes Drill Co., Rockford, Illinois.

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1906 South Rockwell Street, Chicago 8, Illinois

MORE FACTS—Send for free catalog describing Scully-Jones *Precision Holding Tools*. Paste coupon to letterhead or postal card and mail today.

Gentlemen: I'm interested in learning more about Scully-Jones tools.

- ☐ Please send Bulletin 6-50 describing Adjustable Adapters.
- ☐ Send catalog of your complete line.

Name_____

Company_____

Address_____

City_____ State_____

Famous for "firsts"... BELL *Aircraft*

Famous

"FIRSTS"

by BELL Aircraft

Produced with the help of Lake Erie Hydraulic Presses

FIRST
Supersonic Aircraft (X-1)

FIRST
Aircraft to Vary Wing Sweepback in Flight (X-5)

FIRST
Jet-Propelled Fighter in U. S. (F-59)

FIRST
Commercially Licensed Helicopter

●

Record of

LAKE ERIE PRESS PURCHASES

by BELL Aircraft

DATE	NUMBER	TONNAGE
1937	1	750
1939	1	2500
1940	1	275
1941	1	275
1942	1	5000
1943	1	275
1943	1	5000
1943	2	275
1943	4	500
1951	1	400
1952	1	7000

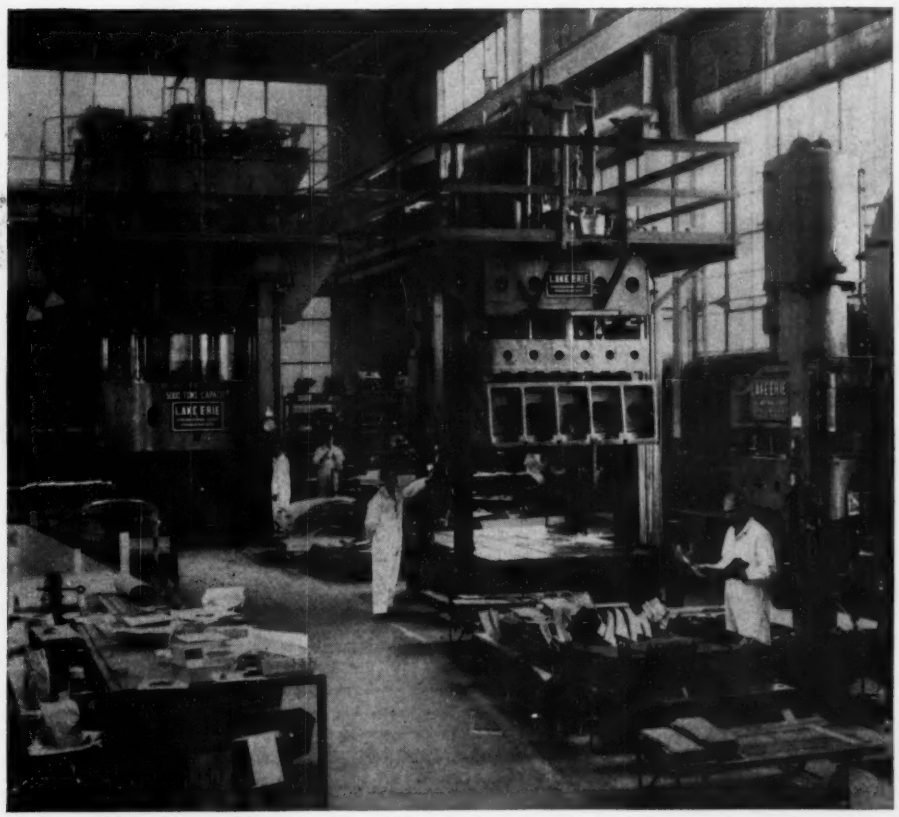
ABOVE. New 7,000 ton press is shown producing Bell helicopter parts...in this instance left-hand aft sills for the HSL-1 engine compartment. Material is 58.00" long by 6:50" wide by .091" thick. Two flanges and a contour are formed. Depth of draw is 3". Pressure required is 5,000 tons. Another new Lake Erie press appears in the background. It is a triple action model with a 400 ton capacity.

● ***Other prominent Lake Erie Press users in the Aircraft Industry***

Aeronca Aircraft Corporation
AiResearch Manufacturing Company
Beech Aircraft Corporation
Bellanca Aircraft Corporation
Bendix Aviation Corporation
Boeing Airplane Company
Consolidated Vultee Aircraft Corp.
Curtiss-Wright Corporation
Douglas Aircraft Company, Inc.
Fairchild Engine & Airplane Corporation
General Electric Company Aircraft Gas Turbine Division
Goodyear Aviation Corporation
Grumman Aircraft Engineering Corporation

places LAKE ERIE *FIRST*

...when it comes to Hydraulic Presses

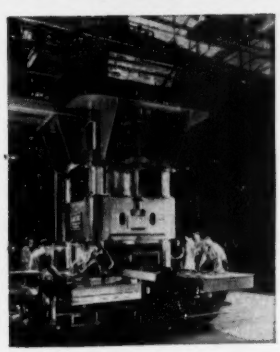


The 15th Lake Erie Press Purchased by Bell is a 7,000 Ton Unit for the New Helicopter Plant at Fort Worth

Bell Aircraft Corporation purchased its first Lake Erie press in 1937. Since then, 14 additional Lake Erie Presses have been added. These 15 presses have 5 different designs and six different capacities ranging from 275 to 7,000 tons. This year-in year-out satisfaction of Bell Aircraft and the variety of Lake Erie equipment involved are significant:

1. They reflect the competence and versatility of Lake Erie designers and builders.
2. They demonstrate that Lake Erie presses do their jobs with gratifying efficiency.
3. They prove that Lake Erie presses give years of the utmost satisfaction.

These are sound reasons why it is always good business to call in Lake Erie when hydraulic presses are under consideration.



ABOVE. A corner of the press room in the Bell Aircraft plant at Buffalo shows three Lake Erie presses with capacities of 5,000 tons, 750 tons and 275 tons respectively. The range in sizes and types, and the versatility of Lake Erie presses are a big asset to airframe, jet engine and accessory manufacturers.

LEFT. Bell's 5,000 ton Lake Erie press shown equipped with a rubber pad. Lake Erie presses of this type are available in capacities from 500 to 7,000 tons producing up to 2,000 p.s.i. on the work. High speed hydraulically operated loading tables or electrically operated tables (as shown above) are available for all press sizes.

LAKE ERIE
HYDRAULIC
PRESSES

Lockheed Aircraft Corp.
Glenn L. Martin Company
North American Aviation, Inc.
Northrup Aircraft, Inc.
Piasecki Helicopter Corp.
Piper Aircraft Corporation
Republic Aviation Corp.
Solar Aircraft Company
Thompson Products, Inc.
United Aircraft Corporation
Chance Vought Aircraft Division
Pratt & Whitney Aircraft Division
Sikorsky Aircraft Division

LAKE ERIE ENGINEERING CORP.

General Offices and Plant
170 Woodward Avenue, Buffalo 17, New York

District Offices in NEW YORK • CHICAGO • DETROIT • PITTSBURGH

Representatives in Other U. S. Cities and Foreign Countries

Manufactured in Canada by: CANADA IRON FOUNDRIES LIMITED

HYDRAULIC PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT

LAKE ERIE ®

New up-to-date machine for high production stretch-wrap forming!

HUFFORD

MODEL A-7
CAPACITY: 20 TONS

Incorporating the latest engineering developments, this new Model A-7 Hufford provides *semi-automatic* operation in a low tonnage machine. It insures considerably higher output than older, manual models of a similar tonnage range and offers, in addition, increased forming versatility with *independent* arm actuation.

FEATURES

SEMI-AUTOMATIC OPERATION—Stretch pressures, wrapping speed and arm positions are pre-set for any given workpiece. These factors are uniformly duplicated on each work cycle.

GREATER UNIFORMITY OF PARTS—with semi-automatic operation all human variations, normally affecting part uniformity, are eliminated.

NO SPECIAL OPERATING SKILL—Once machine functions are properly established, no special skill is required to produce excellent parts.

FEWER LOSSES—Work breakage from overstretching is virtually eliminated on production runs.

INDEPENDENT ARM ACTUATION—Each arm is under independent control, simplifying setups on non-symmetrical dies and adding to forming versatility.

The Model A-7 is the ideal machine for modernizing your stretch-press department. Write for quotation!

Put the Model A-7 to work forming parts like these!

HUFFORD
Machine Works Inc.
EL SEGUNDO CALIFORNIA

Manufacturers of

We took our cue from Mother Nature...

and built FLEXIBILITY into Hufford HYDRA-CURVE Jaws

Up 'til now, all sheets were gripped and maintained in a straight line during stretch-forming. Then a simple observation opened the door to untold savings in material. *If the sheet could be pre-curved to match the cross-sectional die curve, both cross-sectional and longitudinal curvatures could be formed easier, with fewer local strains and with considerable material savings per part!*

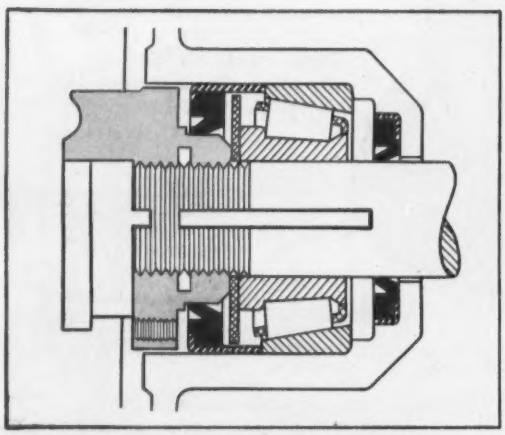
Hufford HYDRA-CURVE Jaws accomplish this fact. They are quickly loaded because all segments assume a straight, in-line position. With hydraulic power the flexible jaws then pre-curve the sheet before stretch-forming.

Since HYDRA-CURVING effects a far more uniform distribution of stresses, local strains are reduced and less failures result. Deeper curves are easily formed and *less material is lost in trimming.* Material savings up to 30% are possible. *Dollarwise, these savings alone frequently cover jaw costs in the first year's operation!*

Our new FREE FOLDER describes many other HYDRA-CURVE advantages. Let us send it today!

New Continental Idler operates 1, 2, 3, or more years without relubrication . . .

WITH THE HELP OF KLOZURE* Oil Seals



The new Continental UST idler uses two KLOZURE Oil Seals—one outboard and one inboard—to insure maximum bearing protection.

This UST factory-sealed belt conveyor idler, developed by The Continental Gin Company, was designed primarily to cut maintenance costs and insure a longer life for both the belt and idler assembly. Continental engineers wanted an idler that would operate satisfactorily without re-lubrication for one, two, three, or more years. That's why they chose a pre-lubricated sealed unit incorporating tapered roller bearings and dependable KLOZURE Oil Seals.

Garlock KLOZURES protect the bearings on Continental idlers by keeping the lubricant *in*, the dirt and moisture *out*. In addition, the KLOZURE assembly prolongs belt life by preventing the leakage of grease on to the belt.

For positive bearing protection specify KLOZURE Oil Seals for your machinery. KLOZURES are made in many models and in a complete range of sizes.

Write for Klozure Catalog No. 10.

Model 71-A Springless KLOZURE, the inboard seal

Model 71-A-7 Springless KLOZURE, the outboard seal

*REGISTERED TRADEMARK

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
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GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916

Yosemite Falls, Yosemite National Park, drops a total of 2,425 ft. in three leaps: Upper Fall, 1,430 ft.; Middle Cascade, 600 ft.; Lower Fall, 320 ft. In spring the roar of this mighty cascade can be heard throughout the upper Yosemite Valley.

LOGAN AIR CONTROL VALVES

Model 6245—4-Way, 2-Position

- BALANCED PISTON
- COMPACT DESIGN
- EASILY INSTALLED
- SELF-CLEANING

79 MODELS

MOST MODELS STOCK DELIVERY

Let Logan Engineers help you design your Air and Hydraulic Circuits

Model 6540
4-Way, 2-Position

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

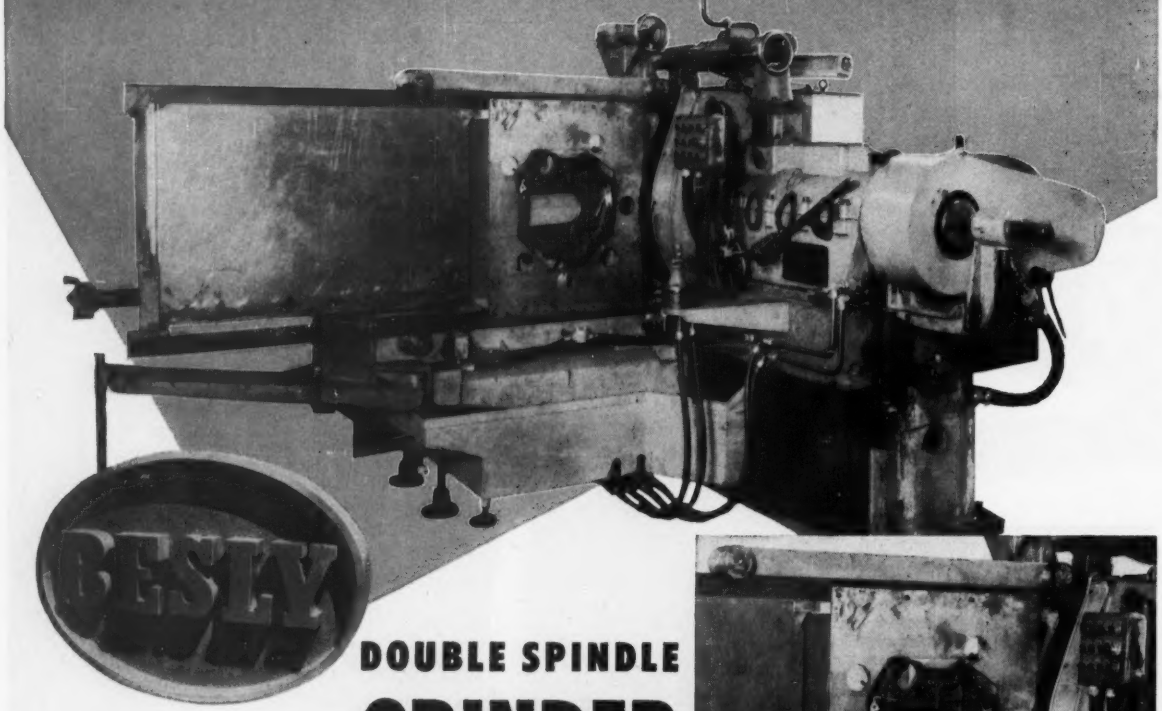
FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

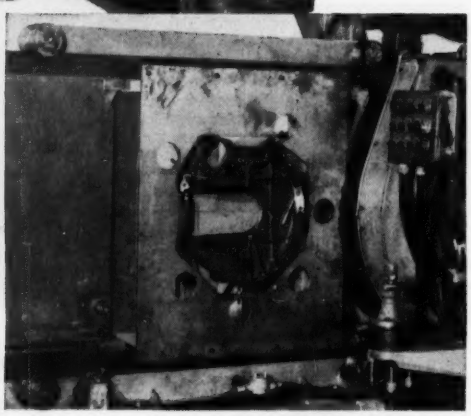
SAVES TIME
Logan
AIR AND HYDRAULIC EQUIPMENT
EFFORT • MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

IT GRINDS TWO SURFACES
For the Price of One!



DOUBLE SPINDLE GRINDER



At a production rate of one a minute, this specially designed Model 226-30" Double Spindle Besly grinds *both sides of torque converter plates at the same time.* With stock removal of .020", accuracy is .003" for parallelism and .006" for size.

This is another example of how Besly grinders are paying off—in this case in higher production for a leading automobile manufacturer. Besly's success in matching the right machine design and the right abrasive to each of many different grinding operations and metals, including the hardest of alloys, is due to over fifty years experience in the grinding field. Our engineers are at your service.

Tailored to Fit the Job . . .

Special jig which holds torque converter plate castings is fed between abrasive discs by long hydraulic piston and cylinder, and oscillated for faster production and greater accuracy. Oscillating movement of jig on slide is controlled by a system of limit switches, timers and solenoid valves. Hydraulic feed of the abrasive discs against the casting is limited by a predetermined stop. Coolant is supplied to the work through the center of the spindles.

BESLY-WELLES
CORPORATION
Established as CHARLES H. BESLY and COMPANY in 1875
112 Dearborn Ave., Beloit, Wisconsin

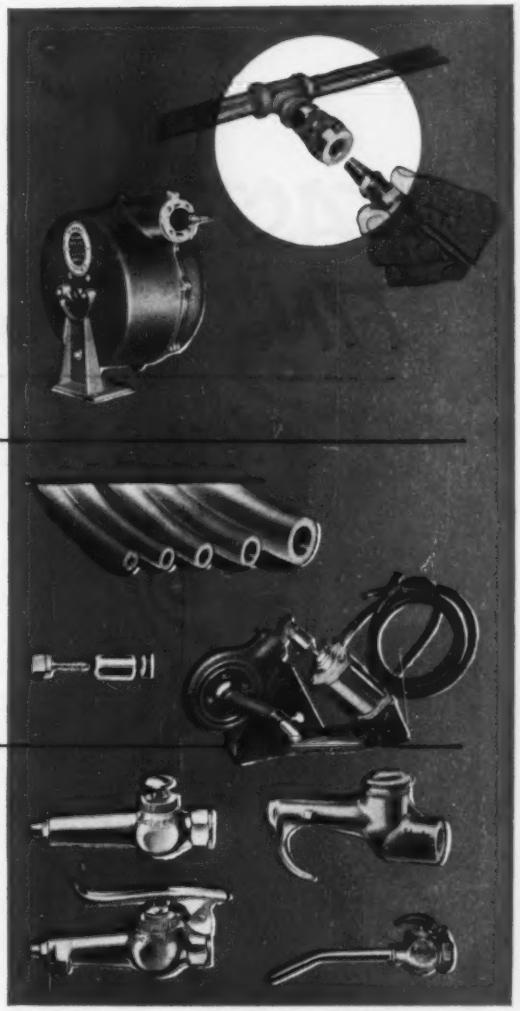
BESLY GRINDERS and ACCESSORIES
BESLY TAPS, DRILLS, REAMERS, END MILLS
BESLY-TITAN ABRASIVE WHEELS

Here's How SCHRADER makes Compressed Air...

CONVENIENT!

With Schrader Quick-Acting Couplers in airlines along walls, benches, columns—compressed air is "plugged-in" as readily as electricity. To connect—simply push adapter into check unit . . . to disconnect, manually turn sleeve of check unit—accidental uncoupling is impossible. They're available in many sizes, to suit your exact needs.

Keep idle air hose out of the way with a Schrader "Tuck-Away" Hose Reel—yet have it available at all times. Schrader Hose Reels work as easily as a window shade—and come in several sizes with up to 50′ of top-quality Schrader air hose.



RELIABLE!

An air tool can be no better than the air circuit that leads to it. With Schrader Hose, Fittings and Ferrule Machines, you're sure of neat, attractive air circuits that will have long, useful lives. Whatever your air needs, you can meet them with Schrader Air Hose and Fittings.

ECONOMICAL!

Whether your air line ends in rugged, practical Blow Guns like these—or Valves, Cylinders, Ejection Sets, Press Controls—you'll find there's a *complete Schrader Line* from which you can select the exact product to give you the maximum return on your compressed air investment. Check with Schrader and see for yourself.

REMEMBER—from air line to air tool—Schrader is *one reliable source for all air control products.* For further information on the air accessories shown here, write for Bulletin A280—or fill out the coupon below.

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REG. U. S. PAT. OFF.

products
control the air

Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

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Please send me my free copy of Bulletin A280.

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at less cost!

CP Hicycle Portable Electric Tools for grinding, sanding, buffing and polishing finish products faster, increase man hour productivity – and at far less cost!

Lightweight and easy-to-handle CP Hicycle tools operate under constant speed – there's no sag under full load. Their Hicycle induction motor and rugged design assure maximum low-cost power and long service life with minimum maintenance . . . has a solid rotor, no armature to burn out . . . no commutator or brushes to replace. If you use or can use six or more portable tools in one location, we would like to demonstrate the advantages of CP Hicycle tools in operation at your plant. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N.Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Jet Engines create *chucking* problems

The Cushman Chuck Company has engineered and designed an entirely new and tested approach to the problem of holding jet engine discs and rings. These new chucks have been developed in strict accordance with the principles of rapid-production techniques and chucking rigidity *without* distortion.

Designed for both hand and automatic chucking operations. Engineered to your requirements.

THE CUSHMAN CHUCK COMPANY
815 WINDSOR STREET
HARTFORD 2, CONNECTICUT

A WORLD STANDARD FOR PRECISION

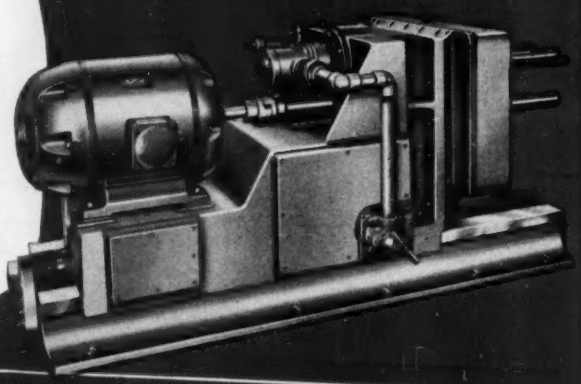
For Aircraft and Automotive Industries

BAUSH
POWER UNITS

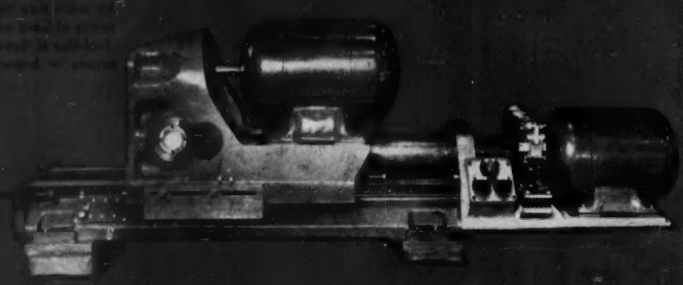
are available in

HYDRAULIC — ELECTRICAL and CAM TYPES

Readily adaptable as individual drives for Transfer Lineups, or for 2-way or 3-way automatic machine tools. BAUSH POWER DRIVES can be mounted vertically or horizontally and offer many practical features.

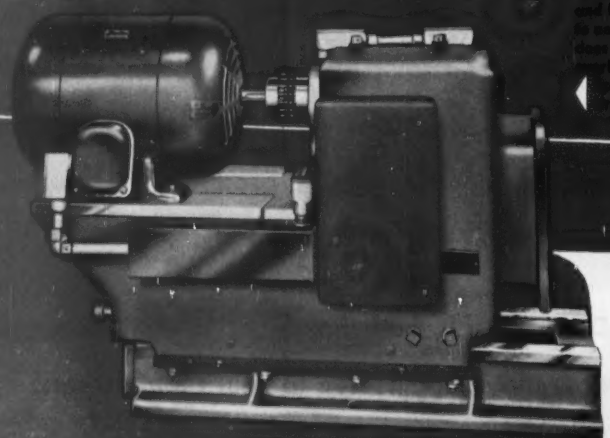


HYDRAULIC FEED POWER UNIT.



7.5 ELECTRICAL UNIT.

CAM UNIT.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

BAY STATE

BAY STATE SALUTES CATERPILLAR TRACTOR CO. . . . for brilliant design in this No. 6 shovel. Here indeed is a remarkable achievement of surging power with maximum compact maneuverability.

Each day, BAY STATE abrasive products play important parts in producing up-to-the-minute mechanical triumphs such as this. Each day too, more manufacturers are realizing the tremendous faith they can place in BAY STATE'S complete line of abrasive products and its excellent engineering service.

Call your BAY STATE distributor for the solution to any problem that involves your production grinding.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Massachusetts

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
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In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

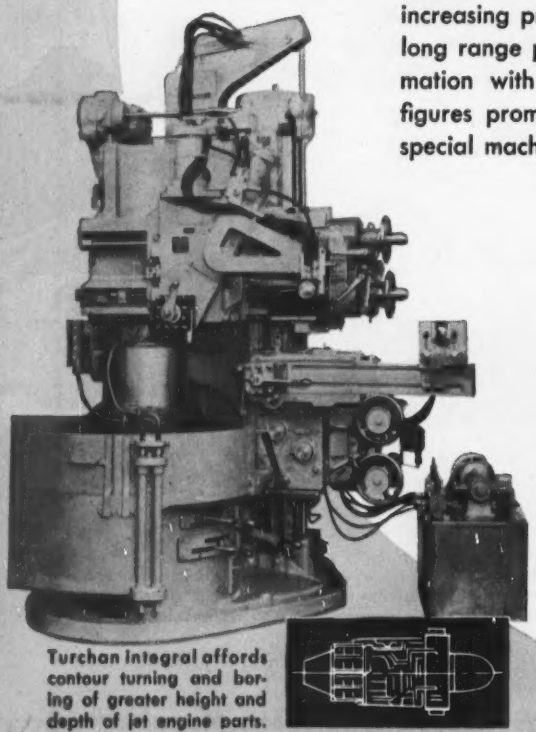
MANUFACTURERS OF ALL TYPES OF QUALITY GRINDING PRODUCTS

Turchan

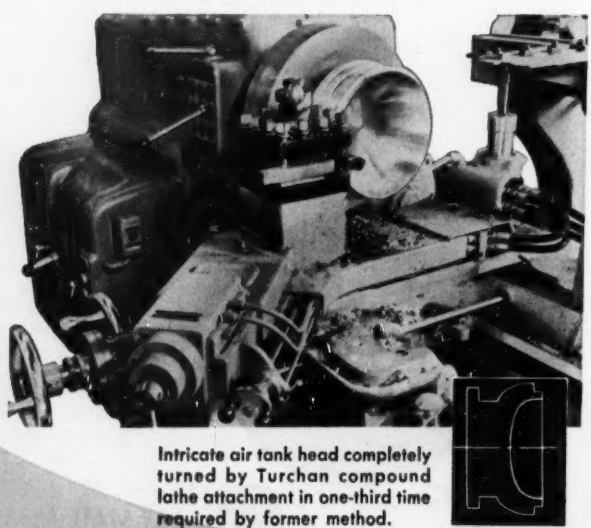
HAS WHAT INDUSTRY NEEDS IN THE TREND TO *Automation*

with TRACER-CONTROLLED machine tools

Across the nation, management men recognize the urgent need for increasing production, improving quality and lowering costs. These long range planners are getting a head start in the trend to automation with tracer-controlled machine tools. Turchan equipment figures prominently in the efficiency of automatizing standard or special machines, regardless of make, model or size.



Turchan Integral affords contour turning and boring of greater height and depth of jet engine parts.

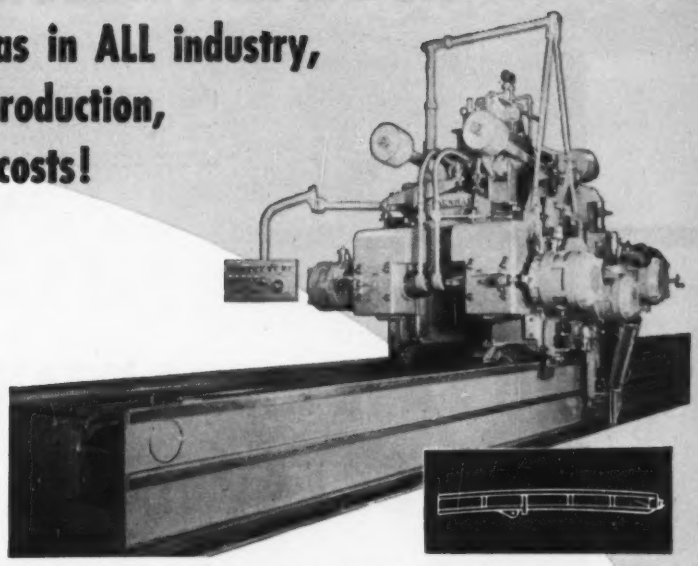


Intricate air tank head completely turned by Turchan compound lathe attachment in one-third time required by former method.

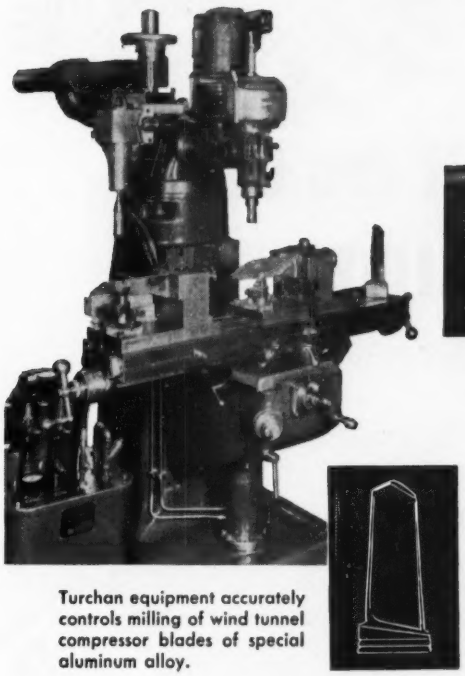
TURCHAN FOLLOWER

8259 LIVERNOIS AVENUE

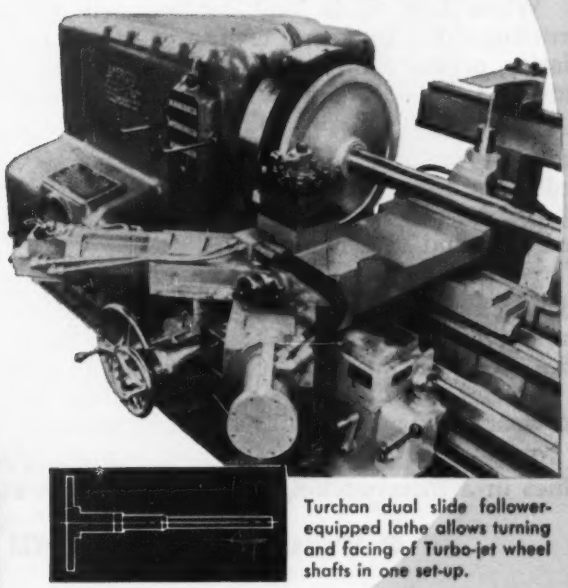
In the aircraft industry, as in ALL industry, tracer-controls increase production, improve quality and cut costs!



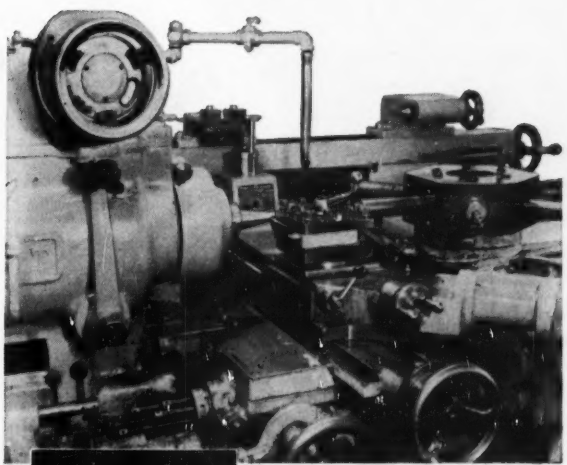
Production milling of spars by Turchan tracer-controlled equipment assures accuracy beyond that of human skill.



Turchan equipment accurately controls milling of wind tunnel compressor blades of special aluminum alloy.



Turchan dual slide follower-equipped lathe allows turning and facing of Turbo-jet wheel shafts in one set-up.



Turchan-equipped turret lathe machines difficult contours from either round or flat template within ± .001" variation.

Investigate what Turchan can do for you — send sketch and specifications for job analysis and full information.

OLDEST MANUFACTURER OF TRACER-CONTROLS FOR MACHINE TOOLS

MACHINE COMPANY

DETROIT 4, MICHIGAN

NO GETTING AROUND IT!

YOU SAVE MORE THAN the OIL with a DE LAVAL PURIFIER

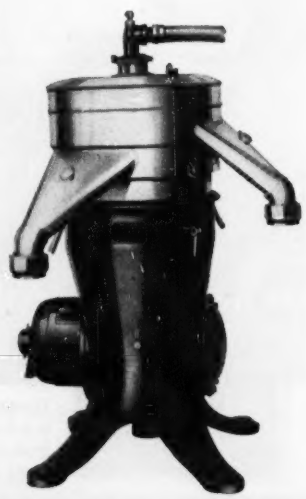
When test oil is kept continuously purified by De Laval Centrifugal Oil Purifiers, testing of machinery of all kinds, from aviation or automotive engines to shock absorbers or transmissions, is safer . . . more reliable . . . more economical.

De Laval Oil Purifiers remove by means of centrifugal force the metallic particles, grit, dirt and water from the oil used in the circulating systems of hydraulic mechanisms, eliminating the danger of scoring delicate parts, even though the oil is used over and over again.

De Laval Oil Purifiers may be used in many other ways to reduce production costs in various types of metalworking plants. One application, for instance, is for the removal of foreign material from cutting oil. Such centrifugal purification makes the oil so clean that higher speeds are possible, tool life is lengthened and wear on machine tool parts is minimized.

There are at least 16 other applications for De Laval machines in a metalworking plant of moderate size.

● Write for the check list MM-1.

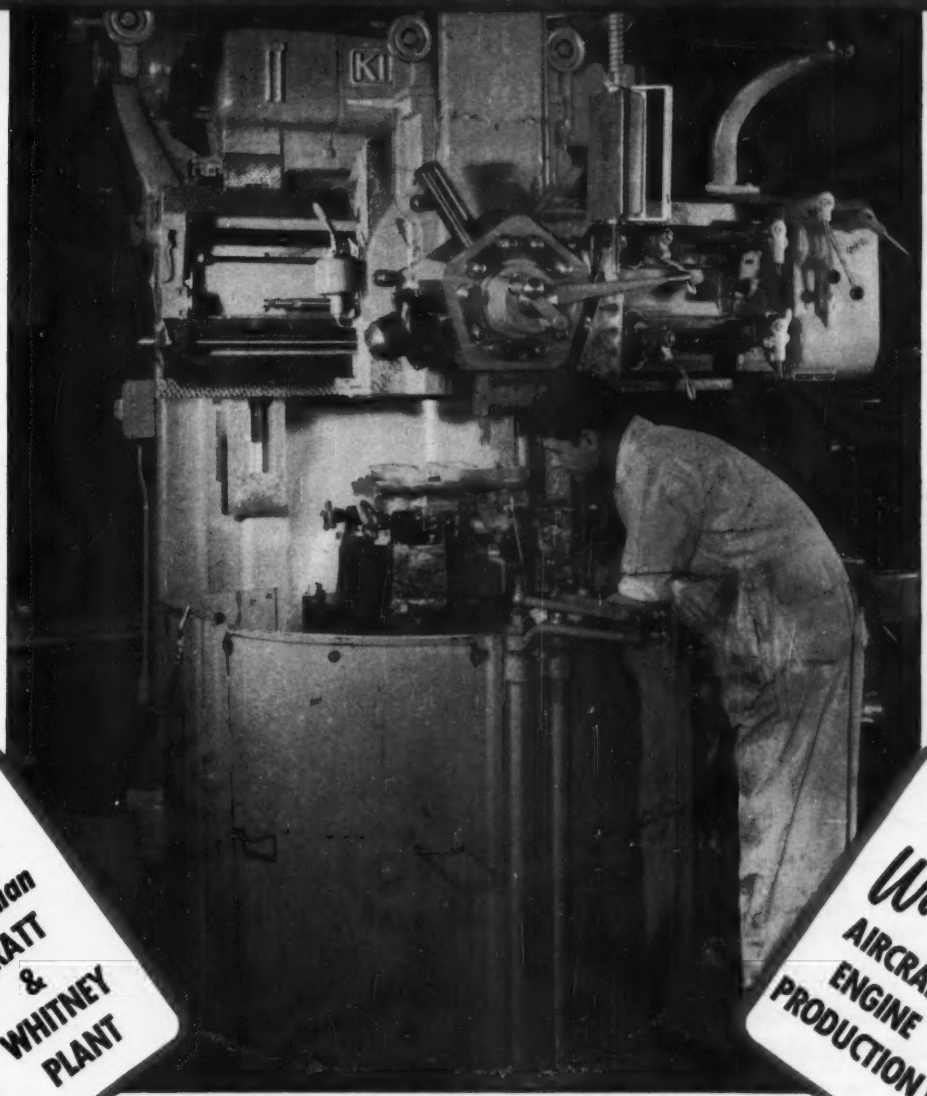


THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

PURIFIERS AND CLARIFIERS FOR FACTORY OILS

It's KING for Precision



AT New Canadian PRATT & WHITNEY PLANT

ON Wasp AIRCRAFT ENGINE PRODUCTION

One of the KING machines at Canada's new Pratt & Whitney plant. This is a 36" mill, shown machining rear crankcase section of the Wasp aircraft engine.

It's only natural that KING Vertical Boring & Turning Machines should be making a substantial contribution to Canada's, as to America's defense effort. Defense production, particularly in aircraft engine manufacture, demands utmost precision. That's where KING is in a class by itself. KING mills have the extra weight, rigidity, and accuracy that assure maximum stock removal without sacrificing precision or quality of finish. KING machines are made in ten sizes, from 30" to 144", all available in a variety of head combinations. For complete details it will pay you to contact your local KING Distributor —or write us direct.

American Steel Foundries
KING MACHINE TOOL DIVISION

KING
VERTICAL BORING & TURNING MACHINES

1750 Tennessee Avenue
Cincinnati 29, Ohio

Beaver BLADE-SETTING AND INSPECTION FIXTURES GIVE FASTER, MORE ACCURATE JOBS . . . CUT COSTS IN HALF!

Adjustable setting-post assembly, (No. F-2861-A), instantly and accurately positions each blade.

This is an F-2861-B fixture with No. 50 NMTB taper spindle and adaptor, equipped with setting-post assembly.

A convenient spindle-lock located on the right side of the spindle, holds the work in any desired position.

Accurate and frictionless spindle takes any tool with No. 50 NMTB taper shank or any style cutter with No. 50 NMTB adaptor.

BEAVER blade-setting fixtures take ALL the guesswork out of blade resetting. These fixtures are also ideal for checking the accuracy of any type cutter or tool after grinding. With the aid of a Beaver blade-setting fixture, the grinding and resetting operation takes about one-half the usual time required. Anyone familiar with milling cutters can do an expert job without long experience. Available in two types—No. F-2213 with solid spindle and adaptor bushings or No. F-2861-B with 50 NMTB Taper spindle mounted in precision, anti-friction bearings.

MODEL F-2213

MODEL F-2861-B

See our Catalog 52 for cost-reducing Beaver Tools

Beaver TOOL AND ENGINEERING CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

DEPENDABILITY . . .
that builds reputation
Delco Motors

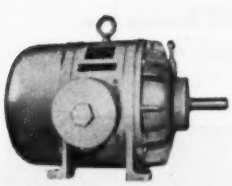
If your product needs a power source, look to Delco for the motor that will serve you best. Delco makes motors for most industrial applications . . . motors famous for dependability and long life under the toughest operating conditions.

So . . . check on Delco. You'll find a Delco motor that fits your needs. For complete details write to Delco Products, Dayton, Ohio, or to the nearest sales office listed below.

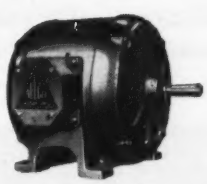
DELCO
DAYTON OHIO

DELCO PRODUCTS

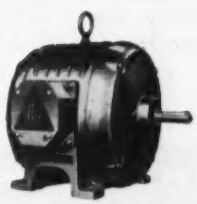
Division of General Motors Corporation
Dayton, Ohio



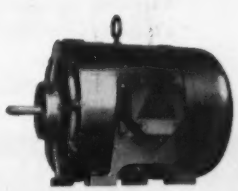
Totally Enclosed Fan-Cooled Motor



Open Ball-Bearing Motor

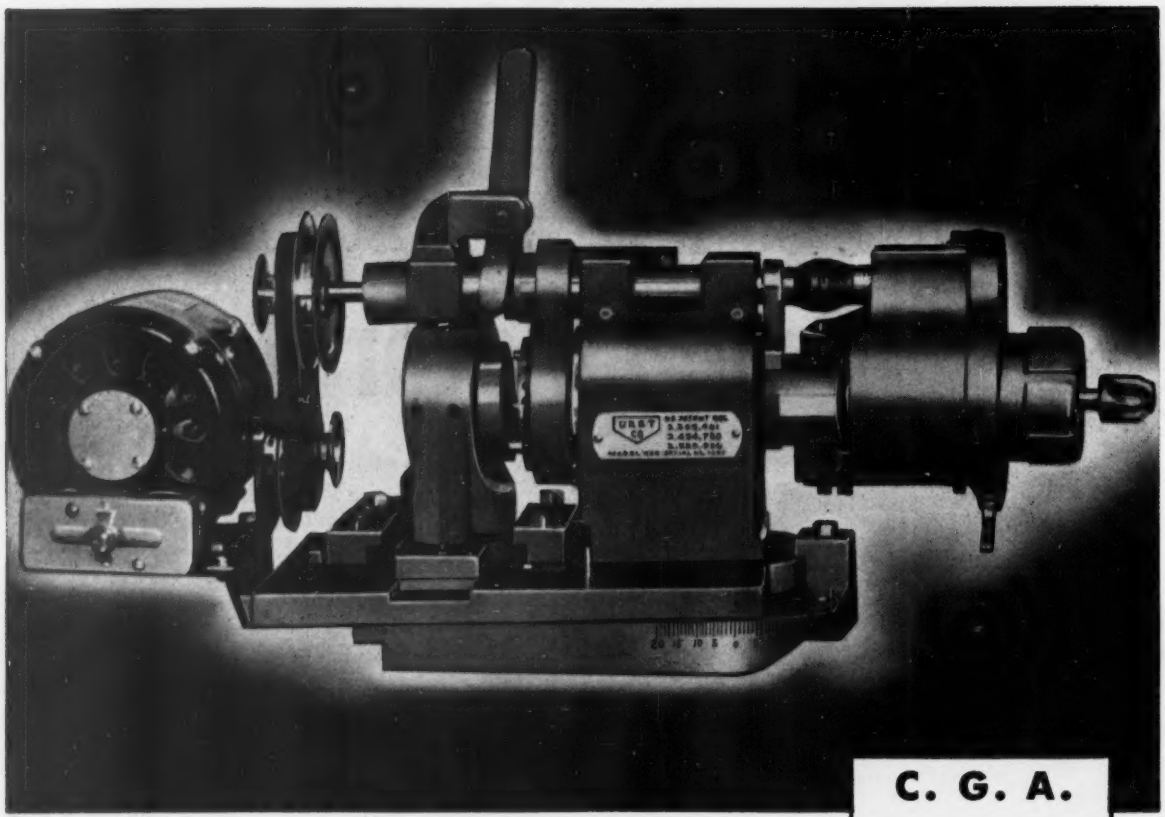


Totally Enclosed Motor



Explosion-Proof Motor

SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco



C. G. A.
MODEL 500

New CIRCULARITY. . . . .
GRINDING ATTACHMENT

Detroit Reamer & Tool Company engineers, after months of intensive research and extensive development, have produced in the model 500 Circularity Grinding Attachment a new device that has many outstanding improvements. This new model is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

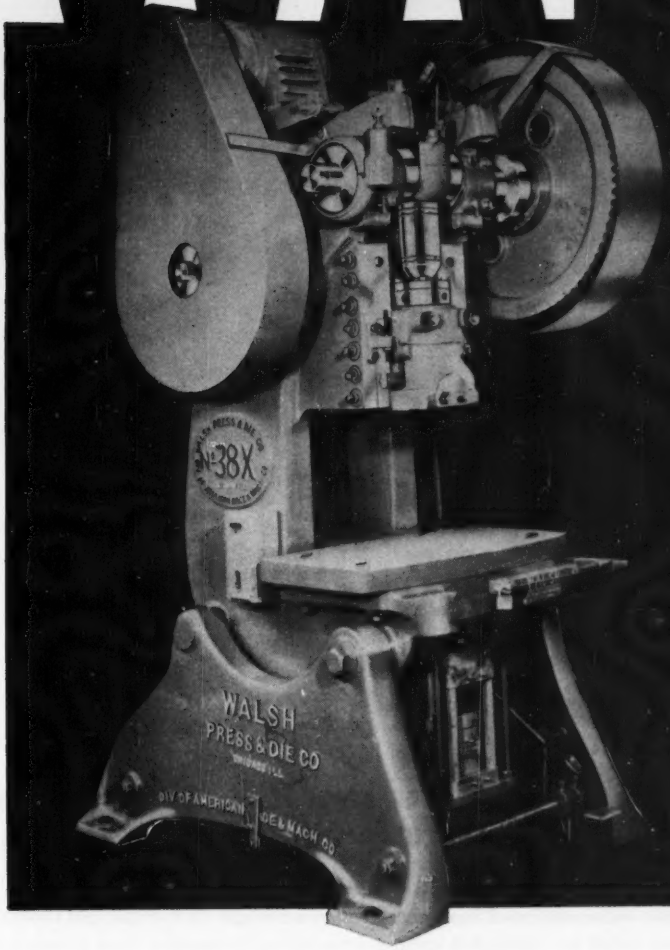
Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY

WALSH



38X

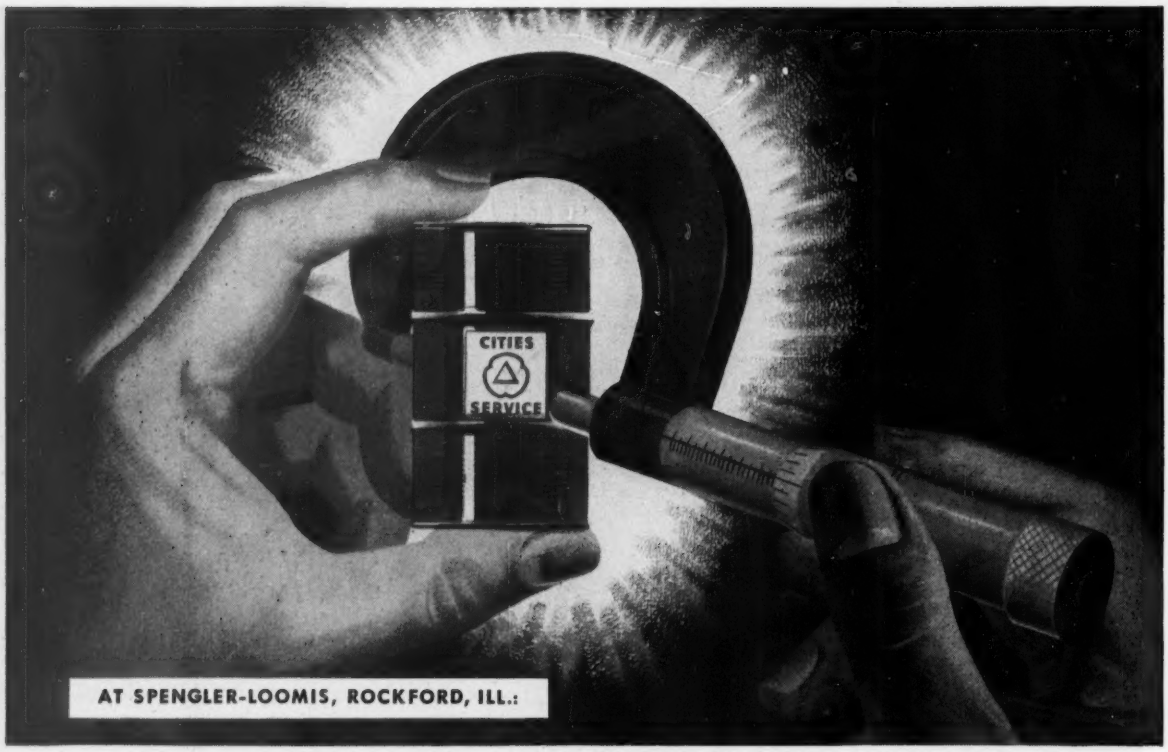
Ruggedness
Dependability
Long Life

Rugged Walsh punch presses made in 1907 are still operating at a profit

All presses lubricated and run-in with Molykote at the factory. For press recommendations without obligation send sample or blueprint to Engineering Department, Walsh Press & Die Co., Division of American Gage & Machine Co., 4709 W. Kinzie St., Chicago 44. EStebrook 8-6700.

WALSH PRESS & Die Company

DIVISION OF
AMERICAN GAGE & MACHINE CO.
SIMPSON ELECTRIC COMPANY · SIZE CONTROL COMPANY · WALSH PRESS & DIE COMPANY



Cities Service Cutting Oils Proved The Very Best By Micrometer Test!

CUTTER MEASURED WITH MICROMETER. As a final test, Automatic Pencil Sharpener measures each cutter with a micrometer. All tests proved that Cities Service cutting oil was absolutely tops for this really tough job.

STRICT SPECIFICATIONS REQUIRE FINEST CUTTING OIL. APSCO Sharpeners offer many more features than other brands. To produce their top quality product, Spengler-Loomis relies on top-quality lubrication products . . . Cities Service Products, famous throughout industry.

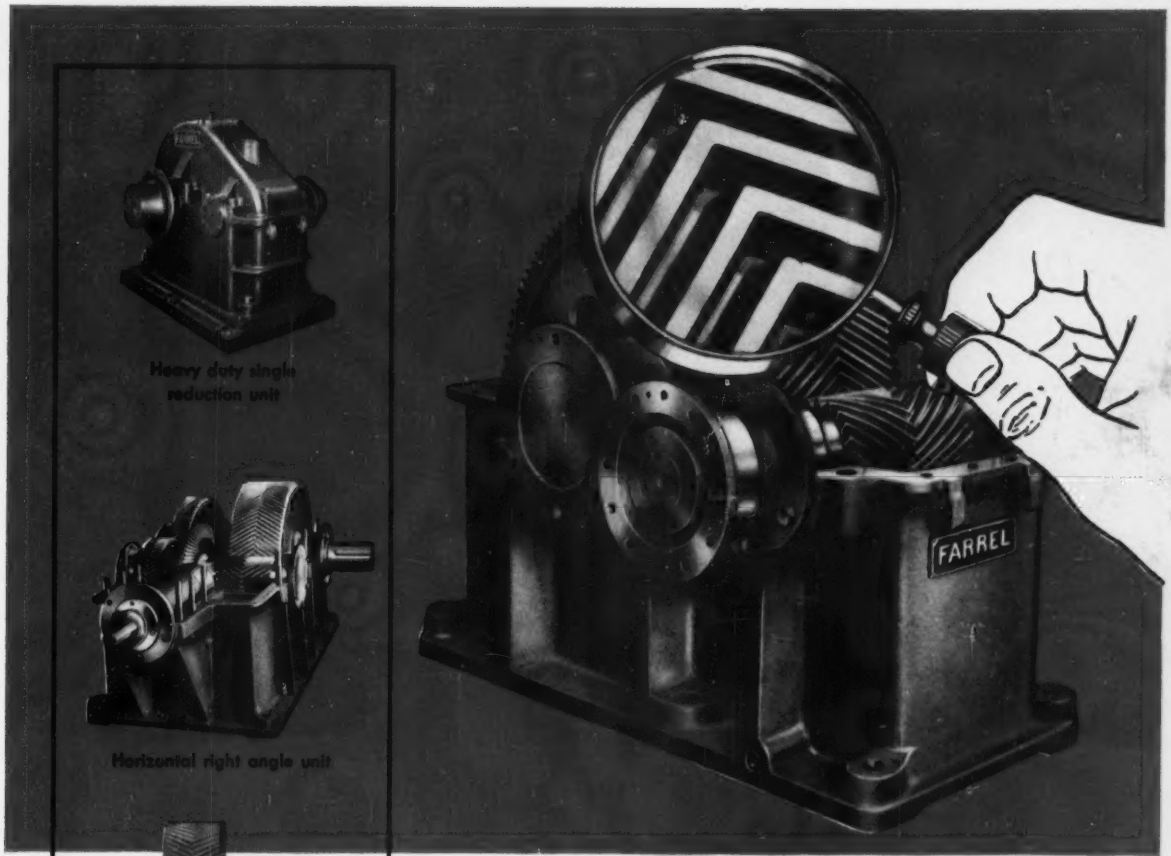
ONLY .005 INCHES BURR OR BUILD-UP ALLOWED IN FIFTY-HOUR OPERATION CUTTING GROOVE IN B1112 STEEL!

Says Mr. C. J. Kostrzewa, Plant Superintendent: "Cutting oil requirements in our Automatic Pencil Sharpener Division are tough. To find the right coolant, we called for, and tested, samples from various companies. Over a period of testing time, we used graphs, charts and tables, keeping a running record on all coolants. As a final test, we measured the cutter with a micrometer before and after milling. The cutting oil that came out tops was Cities Service.

"I'd also like to point out that the Cities Service Engineering staff co-operated fully by offering helpful advice and excellent service."

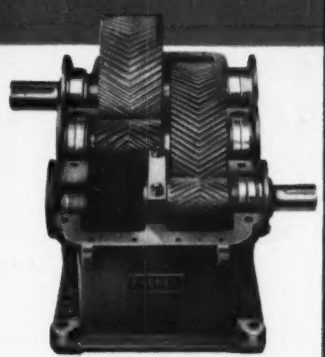
Why not discuss your lubrication problems with a Cities Service lubrication engineer? Write Cities Service Oil Company, Dept. G12, Sixty Wall Tower, New York 5, New York—or contact your nearest Cities Service office.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

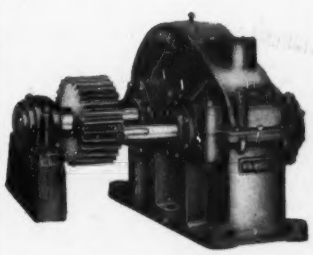


Heavy duty single reduction unit

Horizontal right angle unit



Standard double reduction unit



Unit with pinion on extended shaft supported by outboard bearing

Close-up of a way of life for Speed Reducers

Long, trouble-free speed reducer life is vitally dependent on precision generation of the gears.

The gears of Farrel® speed reducers are made by the famous Farrel-Sykes method — a process that assures accuracy of tooth spacing, profile and helix angle. The herringbone design provides evenly distributed pressure over each tooth, from tip to working depth line. This means that there is no tendency for the teeth to wear unevenly and thus shorten the life of the gears.

Shafts and bearings are factored to safeguard against interruption of vital processes. Gear cases are proportioned to withstand repeated heavy peak loads. Joints are sealed to prevent entrance of dirt.

Farrel speed reducers are made in a number of types, with a wide range of ratios and capacities. Designs include single, double and multiple reduction units, speed change units having two or more selective speeds, right angle drives, and drives to meet special requirements.

Wherever power transmission must be smooth, quiet, and vibrationless under all conditions of load and speed, *specify Farrel speed reducers*. For further details, send for a copy of bulletin 449.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

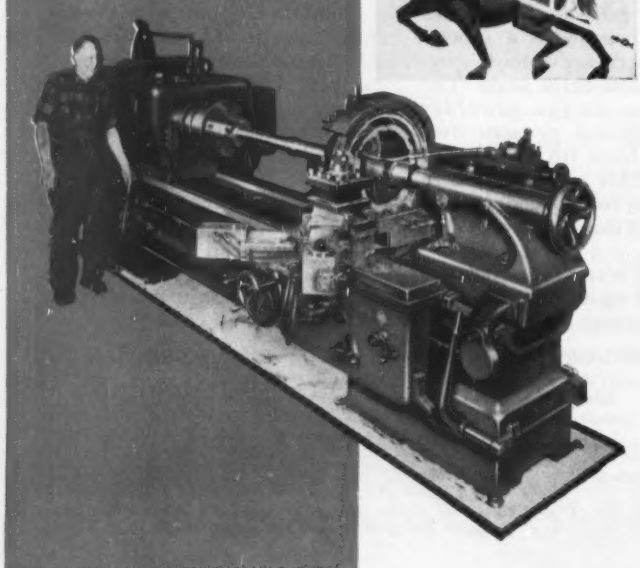
FB-840

Farrel-Birmingham®

G-E JET JOB

being machined in production runs on a Nebel 36" 'F' series heavy duty engine lathe raised 4".

Nebel

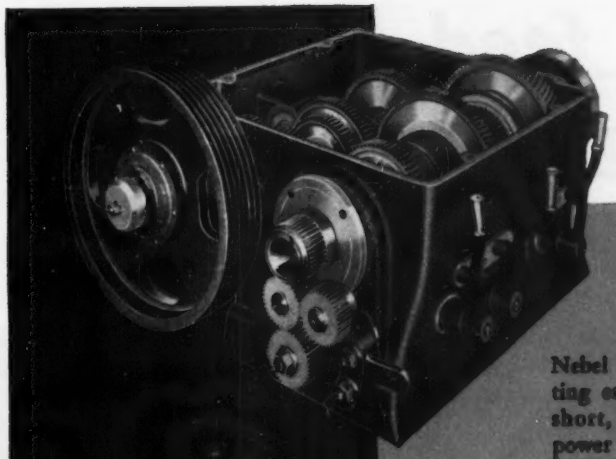


Substantial savings in time, effort and money are plus values Nebel customers have enjoyed for over 53 years. That's because Nebel lathes are basic, and so economical to buy and operate.

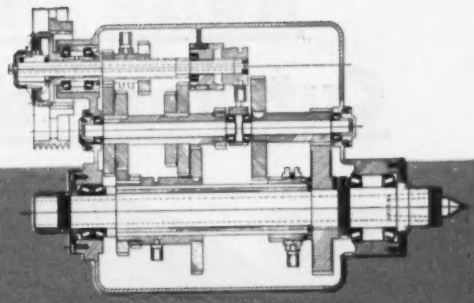
They're made in heavy duty engine, removable block gap and extension bed gap models, in swing sizes from 16" to 50".

Nebel lathes are proving themselves in difficult production assignments like the jet engine program and in exacting maintenance work aboard ships at sea. For such versatility and productivity, Nebel offers you these optional extras: hydraulic duplicating attachment (see opposite page), shaved and hardened headstock gears, hardened steel bed way inserts rapid traverse and others.

Why not send us your requirements today? We'll give you cost-cutting recommendations promptly.



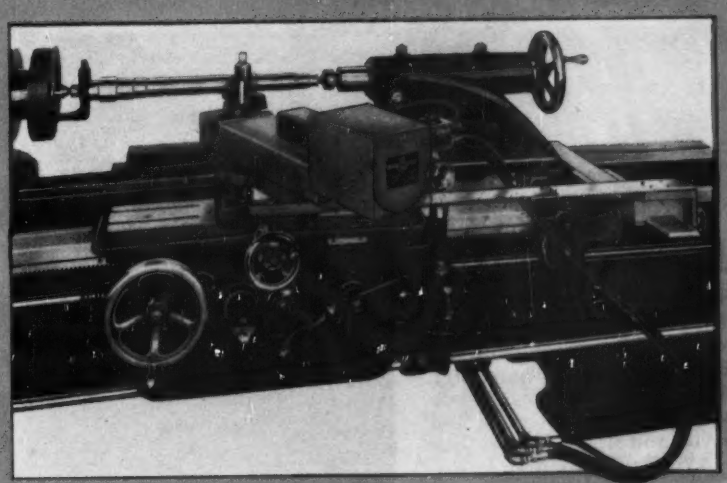
HEADSTOCK POWERHOUSE



Nebel headstocks are dynamos of metal-cutting energy: wide husky gears mounted on short, splined shafts deliver tremendous power to the spindle. And the helical design of drive gears makes for an unbelievably smooth drive.

Spindle is supported on two double Timken anti-friction bearings. On the 'F' series shown above, the front bearings can carry a radial load of 11,495 pounds at 500 rpm and a thrust load of 11,005 pounds at 500 rpm. Note generous use of Timken bearings at all other vital points.

LATHES FOR BASIC ECONOMICAL METAL-TURNING



HYDRAULIC DUPLICATOR

Quickly installed on *any* Nebel latho. Increases production of repetitive work. Designed to utilize the full speed and power of Nebel lathes.

NATIONAL MACHINE TOOL BUILDERS' ASSN. • MEMBERS OF •

THE NEBEL MACHINE TOOL CO., CINCINNATI 25, OHIO, U. S. A.

workhorse of the metal-working shop since 1899.

Raise the feed . . .
Cut your die costs with . . .

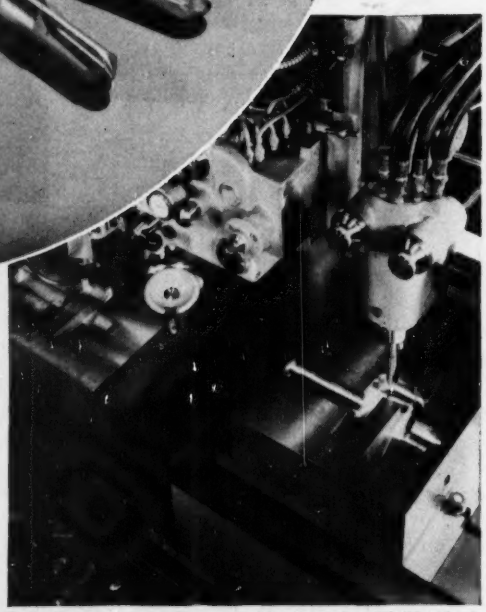
LARGEST SELLING CUTTERS FOR TOUGH DIE STEELS

You get more work between grinds . . . with these *extra rugged* T-J Die Sinking Milling Cutters. That's why they're top favorites in die and forge shops everywhere! T-J Cutters are correctly designed for speed, accuracy and long life . . . hold a sharp edge longer . . . less breakage! Made from an extremely high grade steel . . . properly machined . . . scientifically heat-treated and accurately ground. Wide range of styles and sizes to *reduce your die costs!* Send for new catalog 4-153. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY **T-J**

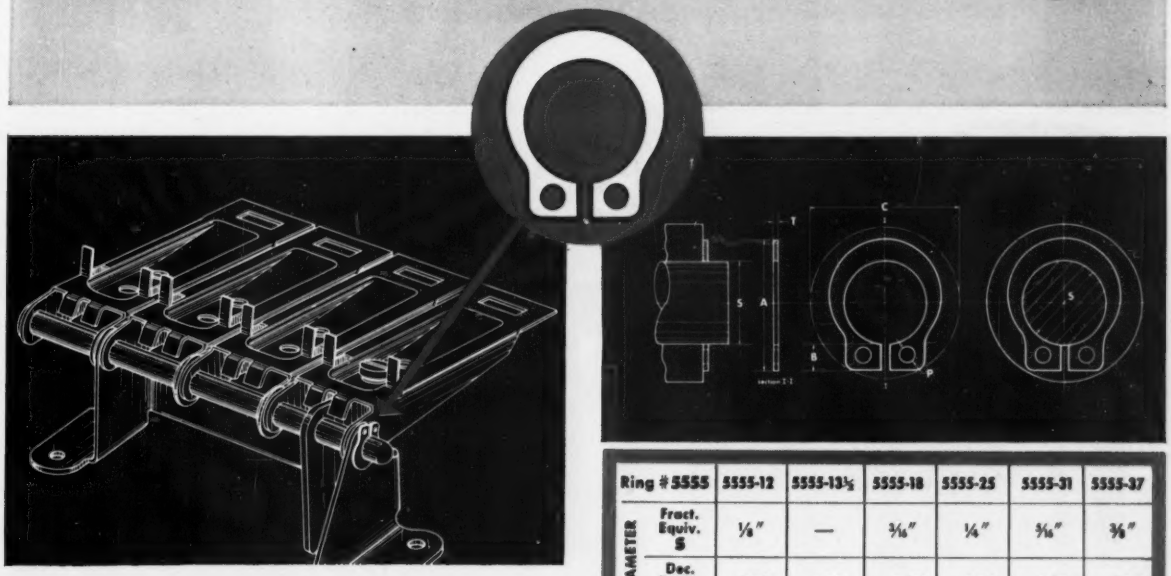
TOMKINS-JOHNSON

RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS



T-J Cutter at work on a Cincinnati 16" Vertical Hydrotel, latest design Die Sinker. A cutter of the right design and heat treatment for this high speed work in tough die steels, making posible the maximum efficiency of these new machines.

New Waldes Truarc GRIP Ring requires no groove, holds fast by friction, can be used over and over again



Ring #5555		5555-12	5555-13½	5555-18	5555-25	5555-31	5555-37
SHAFT DIAMETER	Fract. Equiv. S	1/8"	—	3/16"	1/4"	5/16"	3/8"
	Dec. Equiv. S	.125	.136	.187	.250	.312	.375
	TOL.	±.002	±.002	±.002	±.002	±.003	±.003
RING DIMENSIONS	Thickness T	.025	.025	.035	.035	.042	.042
	TOL.	±.0015	±.0015	±.002	±.002	±.002	±.002
	Length A	.268	.285	.364	.437	.553	.626
	Lug B	.078	.078	.097	.097	.141	.141
	Hole P	.042	.042	.042	.042	.078	.078
	Min. Ring C Clear	.33	.34	.44	.50	.67	.73
Approx. Ultim. Thrust Load (lbs)		20	20	25	35	50	60

The Waldes Truarc Grip Ring is a new, low cost fastener that provides a positioning shoulder secure against moderate thrusts or vibration. Installed on a straight ungrooved shaft, the Truarc Grip Ring can be assembled and disassembled in either direction with Truarc pliers.

The Grip Ring can be installed tightly against a machine part in order to take up end-play. The basic Truarc design principle assuring complete circularity around periphery of the shaft and the ring's unusually large radial width combine to exert considerable frictional hold against axial displacement. The ring can be used again and again.

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Waldes Kohinoor, Inc., M075
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☐ Please send me sample Grip-Rings (please specify shaft size _____)

☐ Please send me the complete Waldes Truarc catalog.

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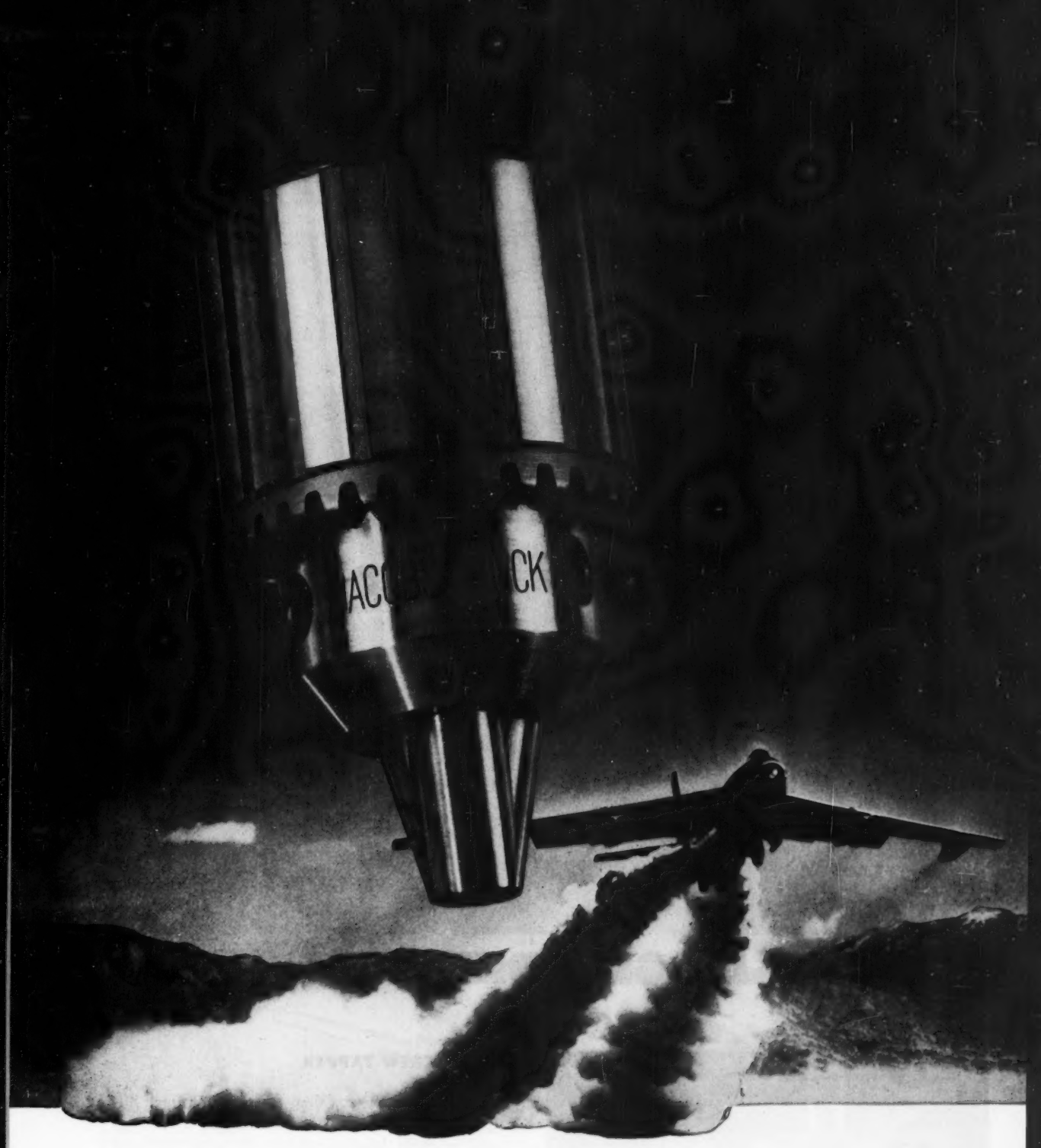

EXTRA POWER *for top performance*

In A Jet Plane, rockets supply the extra launching power needed for fast-climbing takeoff. In industry, Jacobs Plain Bearing Chucks supply the extra gripping power vital to top performance in light- and medium-duty drilling. This, plus rugged construction and precision accuracy, makes them the world's most widely used chucks.

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all holes at one time regardless of angles with quickly-set-up

MAGNA DRILL

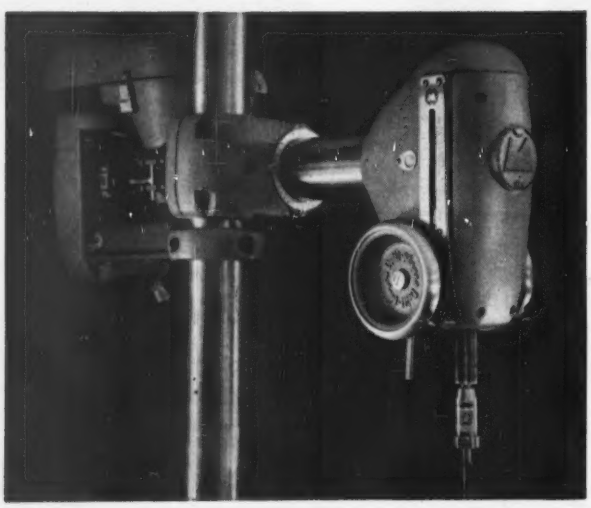
ONLY with MAGNA DRILL can you drill or tap more than one hole in more than one plane at one time—*build the machine around the part in hours instead of days!*

Only with MAGNA DRILL can you feed the drills simultaneously or in sequence by manual or mechanical power—*then remove the quills and substitute lead screw tapping units without knocking down or changing the set-up!*

Only with MAGNA DRILL can you realize all the economies of a custom-built, special-purpose machine at a fraction of the cost—*then change the set-up completely using the same components to do an entirely different drilling or tapping job!*

And only with a demonstration can you realize the full cost-cutting potentials of MAGNA DRILL. See how many ways it can cut costs for you. It takes only a minute to send for the name of your nearest distributor plus complete details and specifications. Why not mark and mail the coupon now?

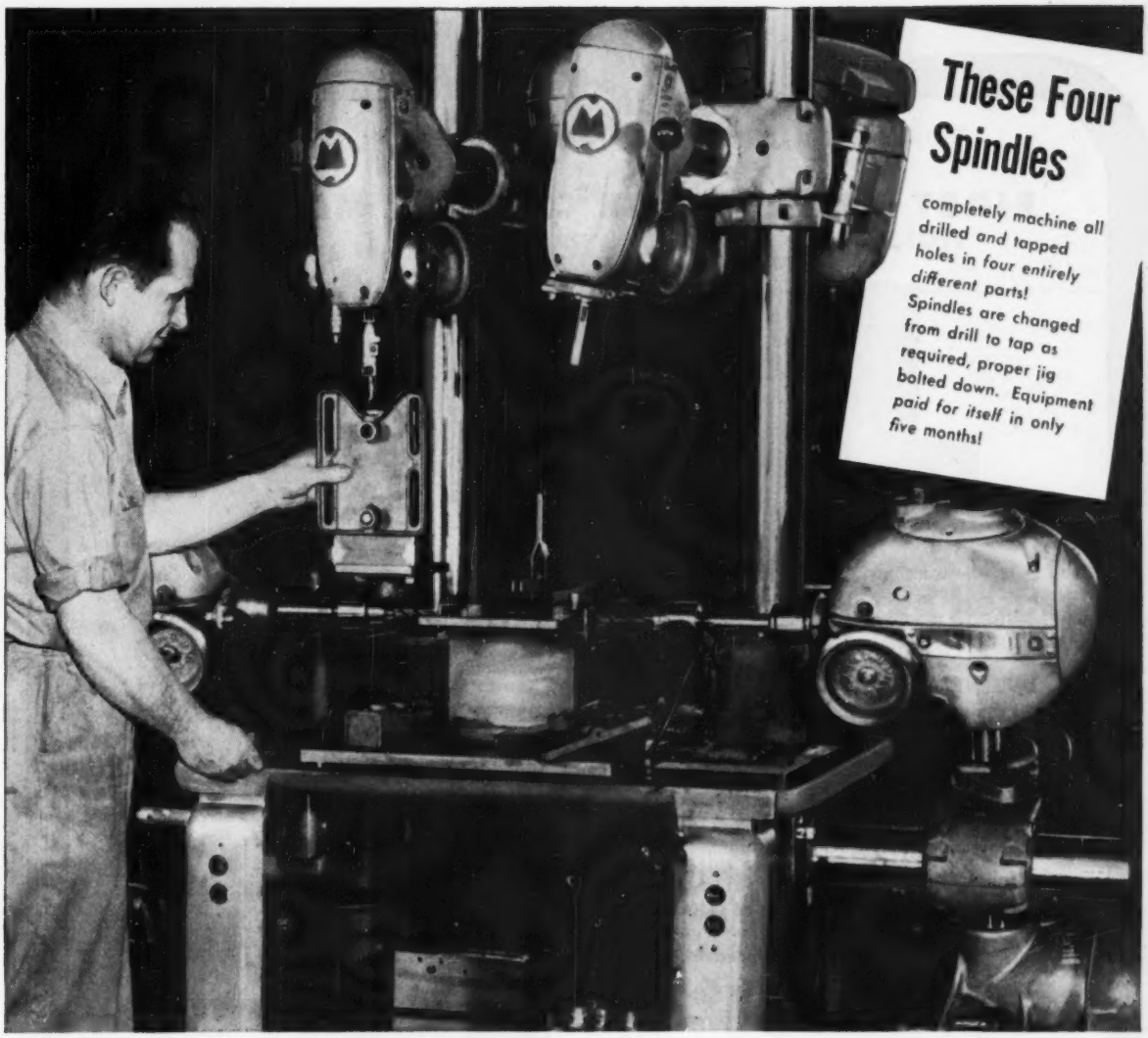
MAGNA DRILL Components



LEAD SCREW TAPPER

Why tap holes one at a time—even if they are at different angles? With MAGNA DRILL you can tap (as well as drill) holes simultaneously using the same basic MAGNA DRILL set-up. Only the spindles need to be changed—a quick, easy job. The special MAGNA DRILL lead screw spindle replaces the quill in the manual feed drill head. No change in set-up or jigging required. No rewiring necessary.

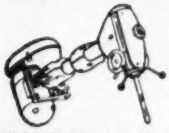
The lead screw tapping unit consists of (1) a reversing starter complete with wiring; (2) the lead screw and bronze nut assembly which replaces the normal quill and (3) a control plate with limit switches which mounts under the front cover. Starter has two-way switch for drilling or tapping.



These Four Spindles

completely machine all drilled and tapped holes in four entirely different parts! Spindles are changed from drill to tap as required, proper jig bolted down. Equipment paid for itself in only five months!

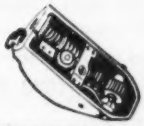
...your keys to complete machine versatility



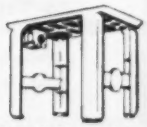
DRILL HEADS Individually powered, adjustable heads can be indexed and locked at any angle or position **without special tools.** Variable throat. Right or left hand manual feed.

COLUMNS and BASES Tubes supporting drill heads are heavy ⅜" wall, 3½" O.D.; are precision ground. Bases are line-bored cast iron; mount horizontally or vertically.

SPEED-REDUCING QUILL Completely replaces regular quill in a few minutes' time. Reduces RPM by 4.4 to 1, spindle speeds down to 86 RPM with 1725 RPM motor.



POWER FEED (Mechanical Type) attaches to MAGNA DRILL head in a few minutes. Feed rates .003" to .012" per revolution. Solenoid engage. Spring return. Automatic cycling.



TABLES Drilled and tapped for mounting head in variety of positions and for ganging tables in multiples. Single table, 24" x 20". Double table, 24" x 40".

Magna Drill Prices F.O.B. Destination:

DRILL HEAD (less motor)	$265
COLUMN AND BASE	45
TABLE (24" x 20")	170
TABLE (24" x 40")	220
POWER FEED (mechanical type)	175
LEAD SCREW TAPPER	255
ADDITIONAL LEAD SCREW AND NUT	50
SPEED-REDUCING QUILL	150

MAGNA ENGINEERING CORP., Dept. 245-S, at factory nearest you,
12819 Coit Rd., Cleveland 8, Ohio, OR
Menlo Park, California

Send me name of nearest dealer and detailed specifications on MAGNA DRILL.

*Name*_____

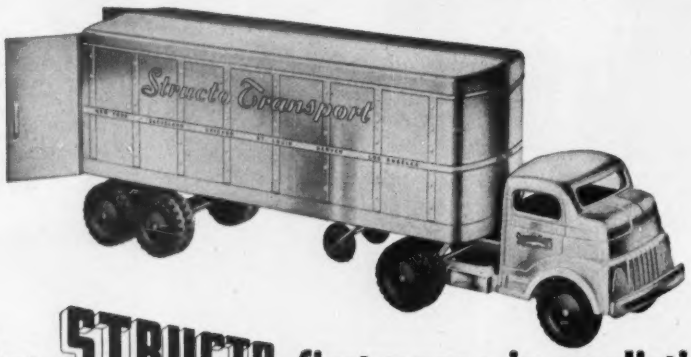
*Company*_____

*Address*_____

*City*_____ *State*_____

KUX

FIRST NAME IN DIE CASTING MACHINES

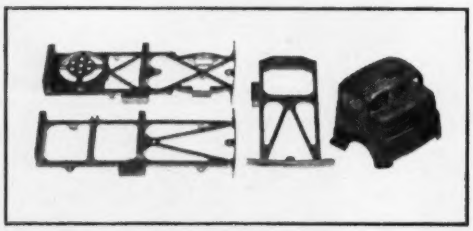


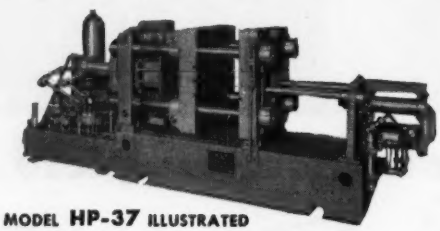
used by STRUCTO first name in realistic toys

UNGENTLE YOUNG HANDS put famous Structo trucks, trailers and steam-shovels through their "live-action" paces again and again. Toys have to be tough to take that. Structo *is* tough. Employing KUX die casting machines, Structo gets lightweight, structural castings of extra-ruggedness . . . to build toys that last a child-time of pleasure!

Is YOUR PRODUCT conditioned for the treatment it has to take? Quality die castings often make a tremendous difference in costs and saleability. KUX, first name in die casting machines, can make that difference for You!

Write for illustrated catalog showing complete line of KUX Die Casting Machines.





MODEL **HP-37** ILLUSTRATED

Hydraulically operated die casting machine for production of aluminum castings.

KUX MACHINE COMPANY • 6725 N. RIDGE • CHICAGO 26, ILLINOIS

KUX

FIRST NAME IN DIE CASTING MACHINES
SELECTED BY FIRST NAMES IN INDUSTRY

NOW - - - an improved water-mix base oil especially formulated for both cutting and grinding application

DASCO
SUPER SOLUBLE BASE

ONE phase of Stuart's continuous research program on metal-working oils and compounds has been directed toward the formulation of a better water-mix cutting and grinding fluid. A heavy duty type water-mixture that would improve machine efficiency on both classes of work, and which could be used at leaner mixtures than normally recommended for soluble oils.

FOR WATER-MIX CUTTING APPLICATIONS. A heavy duty water-mix cutting fluid base, capable of filling the gap between conventional soluble oils and straight cutting oils, must contain more than ordinary petroleum oil if superior performance is to be realized. The manufacture of Dasco Super Soluble Base incorporates a heavy duty base oil — widely known for its performance record on the toughest metalworking jobs.

The advantages gained from this unique feature include superior performance at leaner mixtures than other heavy duty water-mixes. Mixtures normally start at 40 to 1 for turning, drilling, milling, sawing, boring, reaming. Only on some surface broaching, and round hole broaching operations has it been necessary to use mixtures as rich as 15 to 1.

FOR WATER-MIX GRINDING APPLICATIONS. Cylindrical, surface, and centerless grinding operations call for a water-mixture with a higher detergency factor than that found in ordinary soluble oils. Better rust inhibiting and stability characteristics are required because of the leaner mixtures usually used for grinding. Dasco Super Soluble Base has been used for exceptionally long periods of time, at leaner mixtures than 100 to 1, the recommended starting mixture, with no problems due to rusting, separation or rancidity.

TWO WATER-MIXES BUILT INTO ONE. The combination of extra cutting value, high grinding value, excellent stability and great resistance to rancidity makes Dasco Super Soluble Base an ideal water-mix for both cutting and grinding — one that has been especially formulated to give top performance on both classes of work — at leaner mixtures than ordinarily recommended for other heavy duty products — and priced lower than normal for a product of such high quality. Send coupon for complete data.

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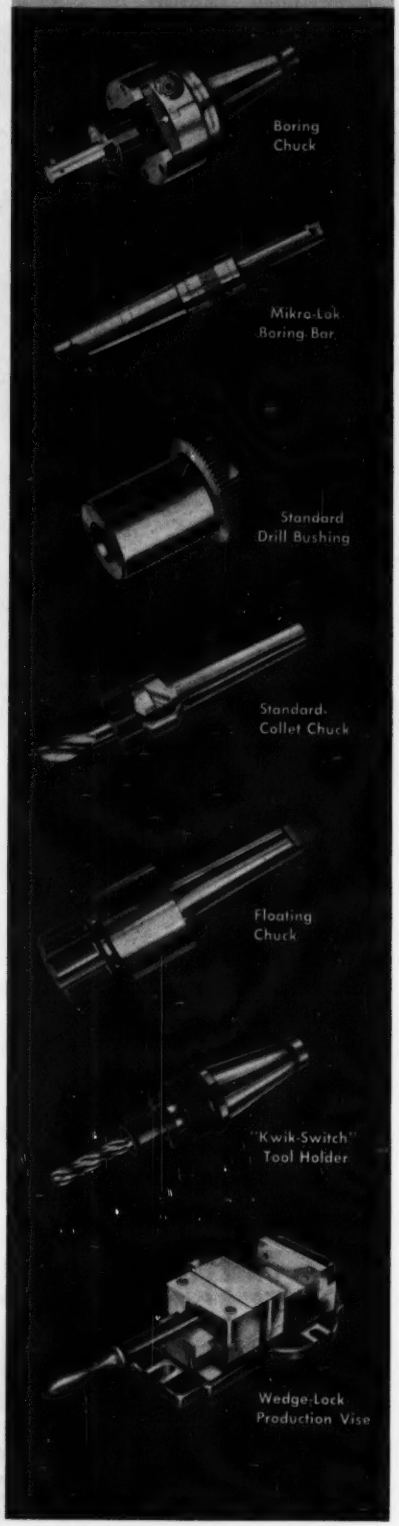
All long-length bushings listed as standard in the Universal Catalog are regular stock items which means speedier delivery to you. If you have been experiencing difficulty in securing long-length bushings, it will pay you to investigate Universal's service. The *super finish I.D.* of Universal Standard Drill Bushings lengthens bushing life . . . reduces tool breakage . . . slashes drill wear.

With the added features of blended radius, knurled head, I.D. break and chamfered O.D., you'll get better bushing service and need less replacements. To further speed delivery order from the warehouse nearest you—1060 Broad St., Newark, N. J., 5035 Sixth Ave., Kenosha, Wisc., or the home office.

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2, MICHIGAN

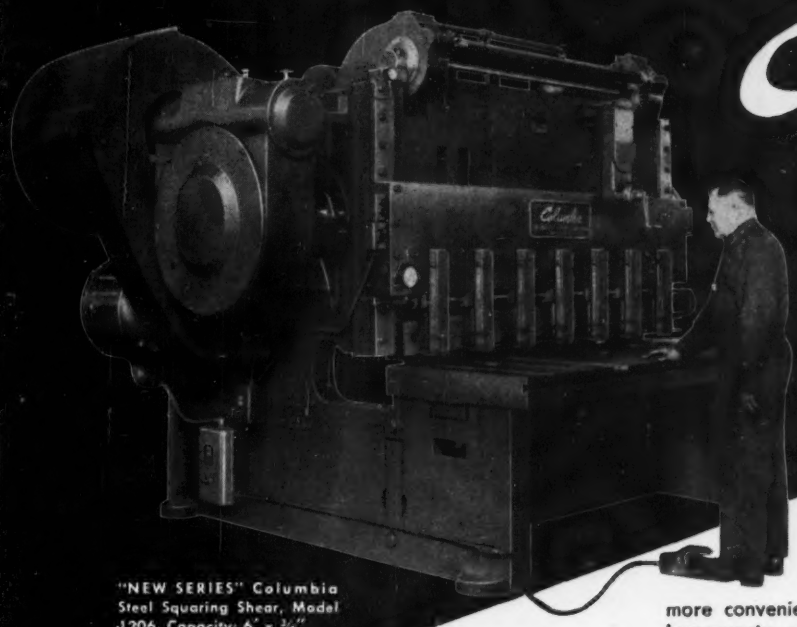
OTHER UNIVERSAL PRODUCTION TOOLS



5315

MAKE NO MISTAKE about it

Columbia builds BETTER shears!



"NEW SERIES" Columbia Steel Squaring Shear, Model 1206. Capacity: 6' x ¼".

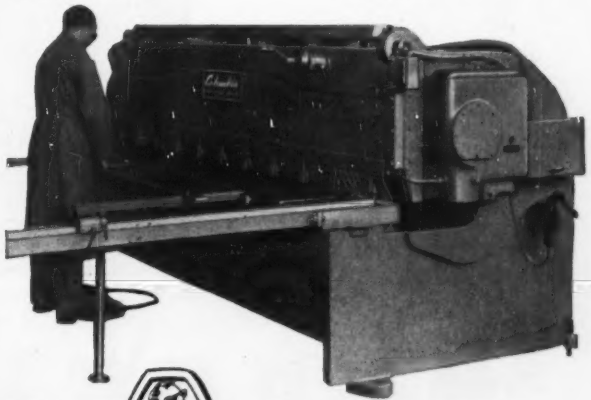
"NEW SERIES" Columbia SHEARS are more convenient in operation, more accurate and safer; incorporate more stamina, have a greater production potential. Consider that fact; and its implied benefits of longer tool life, easier maintenance, fewer repairs, more production, less scrap, fewer accidents!

AS A QUICK EXAMPLE of Columbia's better design take a look at the Columbia exclusive air clutch.

- ★ It reduces gear wear by as much as 75% through elimination of gear movement except in actual cutting cycle.
- ★ Application of power is soft. Shocks are not transmitted.
- ★ Inherent clutch slippage at overload point acts as automatic cut-off.

AND THE DESIGN IS RICH with parallel advantages. Such as the exclusive hydraulic holddown finger connections which contribute so much to the ease of holddown system maintenance; the special slitting provision which extends the capacity of the bed; the blade clearance setting gage, which makes blade clearance setting an "operator function."

Other capacities from 6' x 3/16" to 6' x 1¼", 12' x 1", 14' x ¾", or 20' x ⅜" in mild steel.



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FULL PARTICULARS WILL COST YOU only a minute of your time and the few cents required to mail your request. Don't delay! Even though your purchase of a shear may be a year or more away! Get the information now, and have it at hand when the need becomes urgent.

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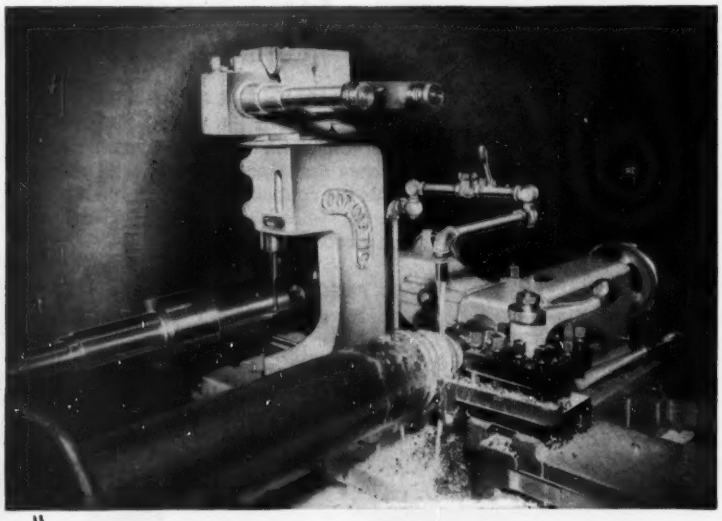
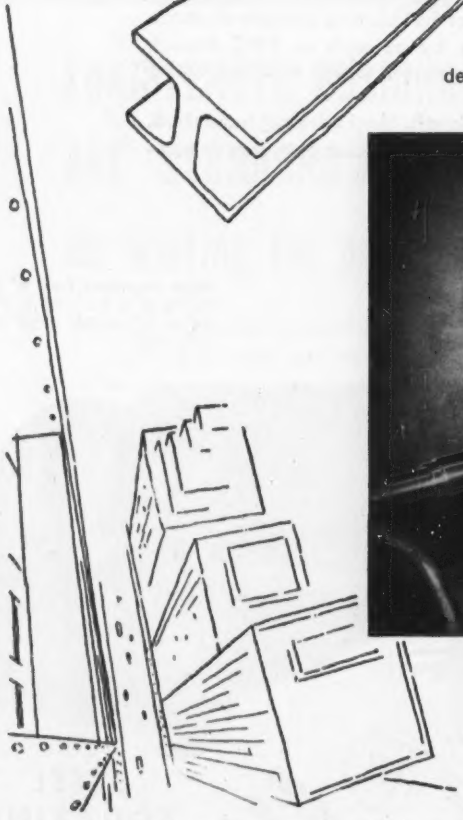
Production soars "up and up" with COPYMATIC Lathes! Case histories prove it!

At the D. O. James Gear Mfg. Co., Chicago, Lodge & Shipley Model X COPYMATICS are beating the output of former lathes by "2 to 3 times" consistently. This customer reports "anything that is turned on a standard lathe" is produced by their COPYMATICS faster and at lower cost. Time saved runs up to 66%!

It costs nothing to submit your toughest job. Write for literature and detailed case histories.





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• This new 8,000-ton hydraulic press, designed and built by BIRDSBORO, is located at Lockheed Aircraft Corporation's factory in Burbank, California. It is the largest of its kind in the world. With a total height of 48 feet, of which 12 feet is foundation imbedded in the floor, this huge machine enables Lockheed to produce larger individual parts with heavier sections of new, tougher metals demanded by tomorrow's high speed aircraft. The operator of this giant press controls a force equivalent to the weight of a battle cruiser as he forms components of tough aluminum alloy a half-inch thick and up to ten by 30 feet in size. The giant press is part of Lockheed's five-million dollar expansion program.

designed & built by **BIRDSBORO**

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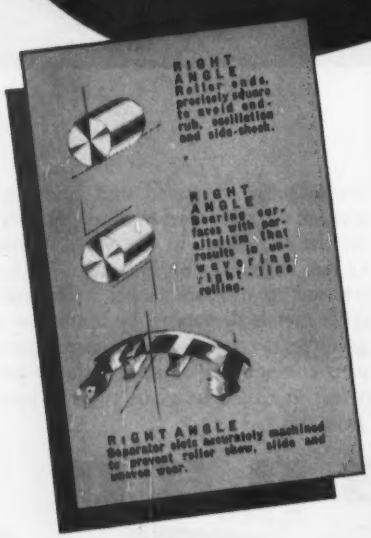
From 30" O.D. to 3" O.D.!

Regardless of size—regardless of type, radial or thrust—Rollway Roller Bearings roll right because they're made *right*. Net result of Rollway's precision "right angle design" is longer bearing service—under heavier loads—with lower maintenance cost.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Roller ends precisely square to avoid end-rub, scalloping and side-shock.
RIGHT ANGLE
Bearing surfaces with parallelism that results in wavering, right-line rolling.
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Separator slots accurately machined to prevent roller skew, slide and uneven wear.

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The Industrial Press

Announces the Publication of the

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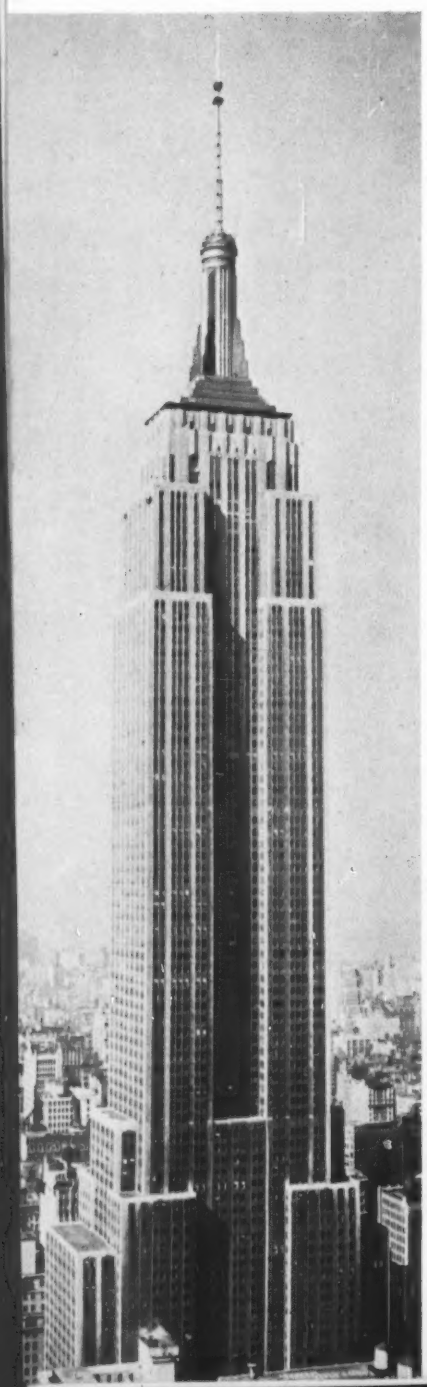
The History of *Machinery's Handbook* Covers Forty Years of Worldwide Metalworking Progress

Since the inception of *Machinery's Handbook* in 1914, the world has witnessed breathtaking strides in every field of metalworking activity. During that period *Machinery's Handbook* has become a standard work of reference, a veritable "Bible of the Mechanical Industries." It has established itself as a universal working tool, finding application throughout the world wherever mechanical equipment is designed, built or operated. Today—1,000,000 copies later—it is an invaluable aid to the engineers, the designers, and the builders who are responsible for establishing and attaining new goals of metalworking achievement.

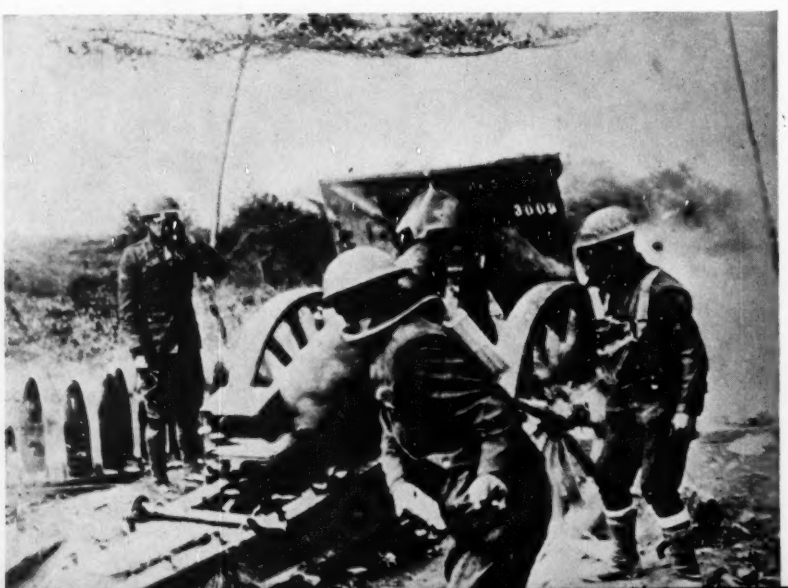


141 EMPIRE STATE BUILDINGS!

Seldom does any technical book achieve the sale of a million copies. The million copies of *Machinery's Handbook* sold since the First Edition in 1914 would make a pile 141 times higher than the Empire State Building, reaching 39 miles into the stratosphere! Laid end to end, they would extend from New York to Albany. *Underwood & Underwood Photo.*

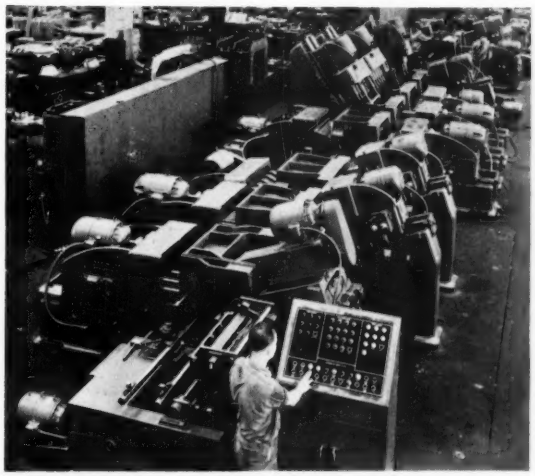
REMEMBER CHATEAU THIERRY?

The photo below shows American doughboys in World War I shelling Chateau Thierry while themselves under enemy gas shell fire. *Machinery's Handbook,* then in its First Edition, provided engineers and production men in America and the other Allied countries, with the technical data they needed to achieve the miracles of mass production that contributed to the eventual defeat of Germany. *United Press photo.*



HE BOUGHT THE MILLIONTH COPY!

In the photo above, Mr. Chester L. Phillips (left) is shown receiving the specially bound millionth copy of *Machinery's Handbook* from Mr. Robert B. Luchars, President of The Industrial Press. Mr. Phillips is General Supervisor of Process Planning at the Glenn L. Martin aircraft plant in Baltimore. In recognition of his purchase of the millionth copy of the *Handbook*, the publishers invited Mr. Phillips and his wife to New York for a week-end of celebration.



MODERN MARVELS OF METALWORKING

Huge, complex machine tools, like this Greenlee transfer machine which performs hundreds of operations in a single sequence, are practical evidence of American machine-building know-how. Designers and builders of mechanical products for every industry have depended for years on *Machinery's Handbook* to provide them with accurate engineering data.

PRODUCTION — AMERICA'S GREATEST WEAPON

Weapons have come a long way since Chateau Thierry. Tanks like those shown below coming off a modern production line vividly demonstrate the tremendous advances made, not only in types of weapons, but also in production methods. America's production capacity and technical knowledge were put to the supreme test during World War II, and *Machinery's Handbook* did its part by providing a convenient, accurate source of vitally needed data.

DESIGNING FOR DEFENSE

Problems in the aircraft industries become so big that these Boeing engineers have spread theirs out on the floor! In every step in the manufacture of a metal product — from plant layout, through design, specification, building and testing, engineers look to *Machinery's Handbook* to give them the right answers — quickly.

MACHINERY'S HANDBOOK

The Mechanical Industries' Ambassador to the World

Shown on the map above are the 77 countries in which *Machinery's Handbook* is used. Wherever machines and other mechanical products are built, the *Handbook* has become the standard reference work. Below are quotations from a few of the many letters of commendation which have been received from industrial leaders all over the world.

UNITED STATES—"We, at Ford, regard this book as an indispensable tool for designers and process engineers. We have found it to be an accurate, convenient, and complete ready reference file, filled with tables, charts and text material covering many problems that our designers and process engineers encounter. You are, indeed, to be complimented on the excellence of this work."

D. J. Davis, Director,
Manufacturing Engineering Office,
Ford Motor Company, Dearborn, Mich.

ENGLAND—"On first entering an engineering factory in the "twenties," the book was by then established as the authoritative reference work. . . . Nearly every copy bears witness to its daily use by the well thumbed pages of mathematical, trigonometrical and gearing tables. When, in addition to this, there is all that wealth of information on engineering principles, methods and materials . . . then the value of this compact volume is realized."

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Sir W. G. Armstrong Whitworth Aircraft, Ltd.
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Montreal, Canada

CHILE—"We practically occupied men, who are confronted daily with smaller or greater engineering problems of machine and tool design, of machine and tool construction, of special and general machine shop activity at large . . . we need a Handbook which is practical, easy to handle and in which we can find quickly the right answers to our questions. And the manual which corresponds to our needs is justly *Machinery's Handbook*."

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Consulting Engineer
Santiago, Chile

BELGIUM—"*Machinery's Handbook* has been in our library for more years than we care to count, and it has been in constant use throughout that period. It contains so much data that cannot readily be found elsewhere, while it represents an exceptional time saver for all those who, like ourselves, operate close to the metalworking industries. The tables and formulae contained in the *Handbook* come in specially handy whenever the user is faced with mathematical computations and problems, the solution of which would normally require reference to several different treatises."

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Etablissements Henri Benedictus
Brussels, Belgium

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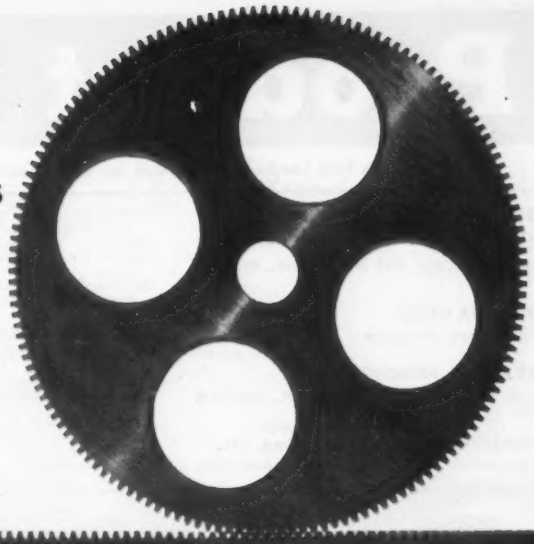
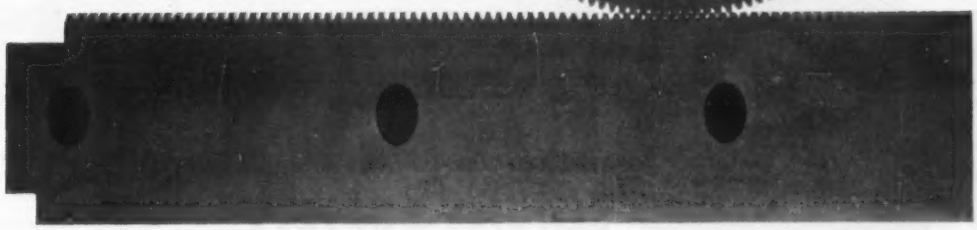
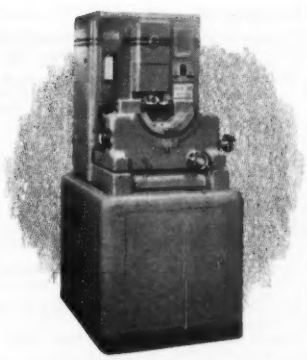
Commissaire a la Normalisation
Paris, France

Here's *Why*

you can check precision gears *more conclusively* with Kodak Conju-Gage Gear Checkers







The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

Why the composite check

Errors in gears seldom occur individually—they're usually combinations of as many as six types of errors. The practical way to test gears for these errors is to test them in action through the composite check recommended in the new American Standard (AGMA 236.02; ASA B6.11-1951).

This check measures gear errors as variations in center distance when the gear is rotated in contact with a master of known accuracy. Since this variation is the sum of errors in both gear and master, the degree of precision measurable depends on the precision of the master.

Why the Conju-Gage Gear Checker

Kodak Conju-Gage Gear Checkers use a master of exceptional accuracy, the Kodak Conju-Gage Worm Section. These Worm Sections are generated by the continuous action of a thread grinder under control of a precision lead screw—circular pitch error and tooth thickness variations cannot be introduced by defects in an intermittent indexing mechanism. This means a more accurate gaging element, less chance that error in the master may coincide with a tolerable error in the gear to result in a needless rejection. Less chance, too, that an error in the master may subtract from an intolerable error in the gear, passing a gear that will fail in use.

By passing each right gear, rejecting each wrong gear, the Kodak Conju-Gage Gear Checker helps you reduce costs while maintaining highest precision. For the full story of this and other economies achieved by Conju-Gage instrumentation, send for the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

Special Products Sales Division
EASTMAN KODAK COMPANY, Rochester 4, N.Y.

CONJU-GAGE INSTRUMENTATION

... a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVE DISCS
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cratex Mfg. Co., 81 Natoma St., San Francisco 5, Cal.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Magnesium
Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page* 324)

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Will give more service for your production dollar . . . Smaller presses will handle heavier jobs.

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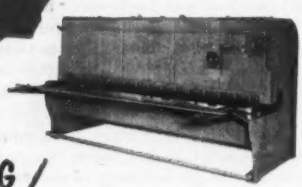

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Will shear mild steel up to 10 gauge . . . less curl and burring . . . no gears or clutch

Johnson MACHINE and PRESS CORP.
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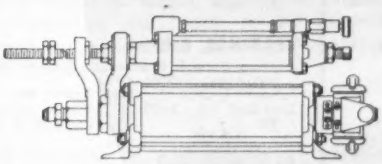
Built-in Controls Make This

AIR CYLINDER POWER UNIT

Fast, Smooth, Compact

TWO MOUNTING STYLES

Model HCBEM Air Motor and Hydro-Check is available arranged in tandem, as shown above, or in parallel, as sketched below:



Five bore sizes: 1¼", 1¾", 2½", 3⅜" and 4½". Stroke lengths up to 18" or more. Combination units of Air Motor and Hydro-Check are also made equipped with the standard Bellows manually operated valve; and of course, Air Motors and Hydro-Checks are available as separate units.

You get the smooth piston travel characteristic of hydraulic operation plus the fast flexibility of air power from the Bellows Air Motor and Hydro-Check, combined in a single unit.

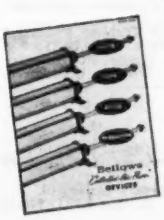
This compact power unit has the built-in ELECTRO-AIRE* directional valve; electrically controlled, but *air-powered.* The valve operates on 8 volts, so you can use simple low voltage wiring. No electrical hazard to operator or machine. Place your controls where you wish. The piston rod responds instantly, without lag or delay.

This power unit is fast. The valve can make as many as 2200 movements an hour, all day long, without overheating. Built-in speed controls (one for the power stroke, one for the retract) let you adjust piston rod speed to your own needs.

But the Hydro-Check is the control element that makes this power unit so radically different. The Hydro-Check flattens out the bounce or chatter that occurs as a result of the natural compressibility of air. The air cylinder piston movement becomes miraculously smooth. You have the smoothness of hydraulic operation plus the advantage of air's speed and flexibility. You can set the Hydro-Check to take over control at any point; so you can have rapid advance and rapid return, yet have full control over the feeding stroke.

All in all you just can't beat the combination of Bellows Air Motor and Hydro-Check for fast, smooth, accurately controlled air cylinder power.

* TM Reg. Patent Pending



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for this FREE Bulletin

Photographs, wiring diagrams, technical data, case histories, etc., on Bellows Air Motors, Hydro-Checks and other Bellows "Controlled-Air-Power" Devices. Shows how easy it is to use flexible, economical air power for "Faster, Safer, Better, Production." Address Dept. MA753, The Bellows Co., Akron, 9, Ohio.

1255

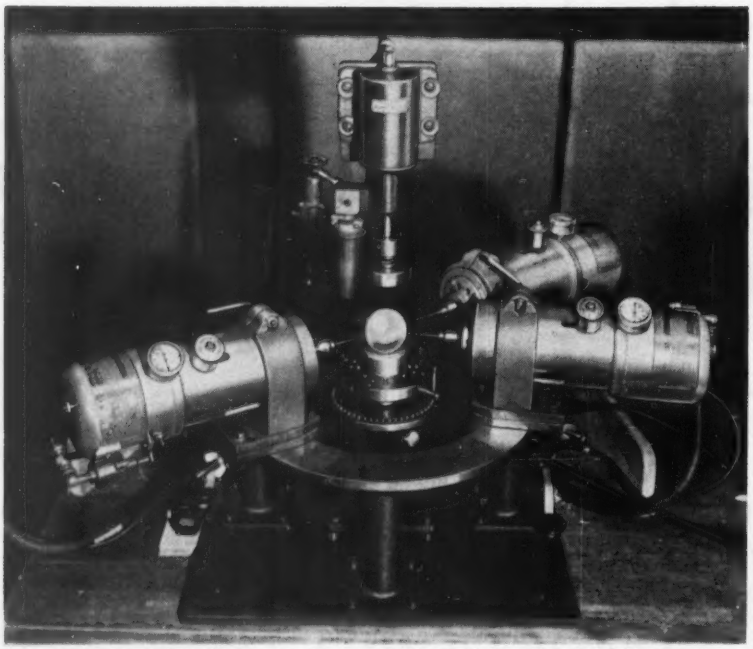
The Bellows Co.

ESTABLISHED

AKRON 9, OHIO

DUMORE® DRILL HEADS

increase production 322% for toy manufacturer



The 3 Dumore Drill Heads are mounted on a special fixture which positions and holds the work . . . automatically indexes the workpiece on a timed cycle. The company reports, "Our study has discovered no competitive or comparable machine for the speedy drilling of holes in plastic."

. . . save $13.74 per thousand plastic balls drilled

A METHODS study revealed that three Dumore Automatic Drill Heads mounted on a special fixture cut this manufacturer's production cost from $18.00 to $4.26 per thousand balls drilled.

Based on yearly output of 500,000 balls, this meant savings more than four times the original $1,600 cost of the Drill Heads and fixture. What's more, this company found that the Dumores' flexibility also helped make substantial reductions in necessary shelf inventory.

As a company spokesman put it, "Low initial cost plus flexibility and ease of operation make the DUMORE a 'natural' for multiple drilling operations."

In most cases, if you're drilling small holes in wood, plastic or metal, you, too, can cut production costs. For details, see your Industrial Distributor or write:

Builders of precision fractional hp motors, hand grinders, tool post grinders, drill grinders, flexible shaft tools, quills and automatic drill heads.

DUMORE PRECISION TOOLS

The Dumore Company

1343 Seventeenth Street • Racine, Wisconsin

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Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BALLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Kennametal, Inc., Latrobe, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Coid Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Torrington Co., Torrington, Conn.

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Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

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Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
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S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

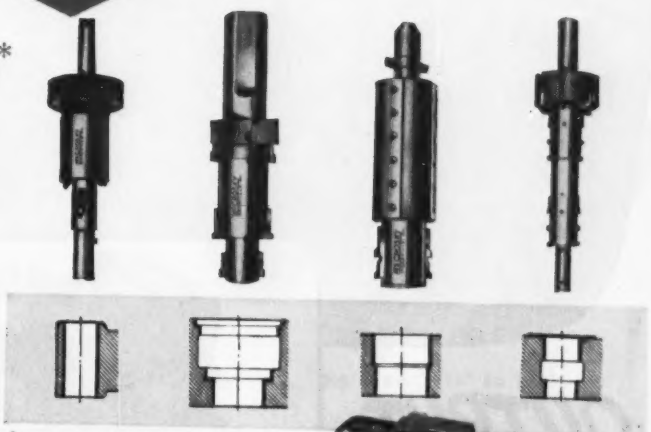
(*Continued on page* 326)

McCROSKY

COST CUTTING TOOLS

V-centering *Block Type** BORING BARS

Ruggedly built for accurate low cost dependable operation



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* U. S. Patent 2,076,663

McCROSKY *Universal* MILLING CUTTERS

Body can be bladed to rotate either right or left hand. Consequently, selecting blades with tips of proper material mounted at proper angles produces a cutter that meets any metal or machine condition. Write for Bulletin No. 531 today.

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Complete line includes chucking reamers with straight or tapered shanks, shell reamers with tapered holes for standard arbors or large straight holes for line bar reaming. Stock sizes from 15/16" to 6" diameter. High speed, cast alloy or carbide tipped blades. Write for Bulletin 18-R.

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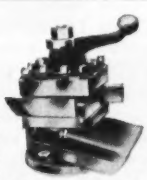
Face Mills, Shank and Shell End Mills, Half Side and Staggered Tooth Milling Cutters fitted with high speed steel, cast alloy or carbide tipped blades. Sizes from 3" to 24" in diameter to meet any requirement. Write for Bulletin No. 17-M.

McCROSKY *Turret* TOOL POSTS



These tool posts permit successive tools to be swung into cutting position quickly, indexed accurately, and locked rigidly, giving engine lathes many of the advantages of turret lathes. Four styles—11 sizes. Write for Bulletin 17-T.

McCROSKY *Wizard®* QUICK-CHANGE CHUCKS

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McCrosky "Specials" combine two or more related boring, facing, chamfering or reaming operations into a single tool saving set-up time and cutting costs. Engineered by McCrosky to your work prints. Write for Bulletin 17-S.

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McCROSKY TOOL CORPORATION

MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

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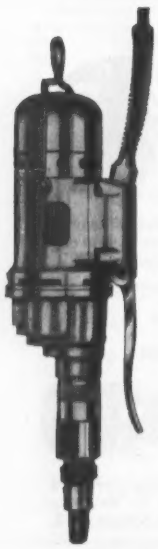
OUTPUT JUMPS 110%

Actual height overall 1-5/8"

"Hi-Drive" — big name in midget motors — manufactured by Blake Manufacturing Division, Ray-O-Vac Company, one of the world's largest producers of miniature motors, flashlights and dry batteries.



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Driving tiny, self-tapping screws in a thin plastic housing — it's the kind of job usually considered too delicate for power drivers.

Yet, Millers Falls No. 52's with the *patented* "Adjustomatic" Clutch are performing this operation speedily, accurately — without splitting the plastic walls — without stripping threads. And — production has more than doubled.

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The Mark of Superiority

MILLERS FALLS COMPANY
Greenfield, Mass.

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Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
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Torrington Co., Torrington, Conn.

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Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
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C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
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Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)
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Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
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Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracekn St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Shafer Bearing Corp., Downers Grove, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

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BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

(*Continued on page* 330)

self-locking fasteners

Elastic Stop nuts

HEX NUT

SPLINE NUT

HIGH TENSILE NUT

CLINCH NUT

1200° F. HIGH-TEMP. NUT

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Every major aircraft now being assembled relies on the vibration-proof holding power of ELASTIC STOP nuts. Only ESNA manufactures a complete line of all types and sizes of self-locking nuts.

Rollpins

dia. from 1/16" to 1/2"

Rollpins are slotted, tubular steel, pressed-fit pins with chamfered ends. They drive easily into holes drilled to normal tolerances, compressing as driven. Extra assembly steps like hole reaming or peening are eliminated. Rollpins *lock* in place, yet are readily removed with a punch and may be reused.

Cut assembly costs by using Rollpins as set screws, positioning dowels, clevis or hinge pins. Specify them in place of straight, serrated, tapered or cotter type pins.

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ROLLPIN TRADEMARK

Mail Coupon for Design information

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2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

- ☐ Elastic Stop Nut Bulletin
- ☐ Rollpin Bulletin
- ☐ AN-ESNA Conversion Chart
- ☐ Here is a drawing of our product. What fastener would you suggest?

Name_____ Title_____

Firm_____

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The head of a pin holds these cutting tools .....

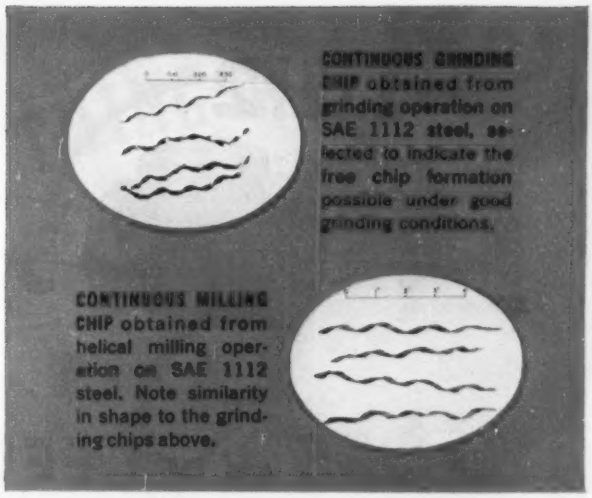
HERE'S THE START OF ENTIRELY NEW CONCEPT IN

CINCINNATI GRINDING WHEELS

The starting point of an entirely new approach to grinding wheels is the tiny grinding grit. For years of research by Cincinnati Milling confirms, beyond doubt, that the grinding process is a true metal cutting process. The millions of grinding grits in a grinding wheel do not abrade or wear away the surface of a workpiece but form chips which agree in classification with the basic chip types found in other metal cutting processes.

This new concept is not based on hasty conclusions. It represents 25 years of Cincinnati Milling research, coupled with practical experience in applying the basic fundamentals of grinding to a wide variety of work on both centerless and centertype machines.

Here is the starting point of the development of the grinding wheel as a true cutting tool. And it is a development you might expect from Cincinnati Milling, with


CONTINUOUS GRINDING CHIP obtained from grinding operation on SAE 1112 steel, sectioned to indicate the free chip formation possible under good grinding conditions.
CONTINUOUS MILLING CHIP obtained from helical milling operation on SAE 1112 steel. Note similarity in shape to the grinding chips above.

the world's largest background of research and experience in metal cutting operations.

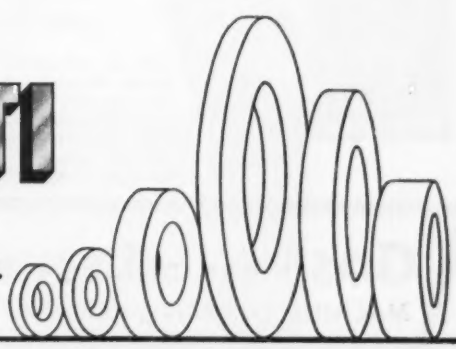
For you, this means grinding wheels developed and tested over a period of years on the basis of true function—as true cutting tools forming true chips.

Available to you is a field organization of trained machinists who know grinding and grinding machines as well as grinding wheels. For a demonstration on your own machines of how to get the most out of Cincinnati Grinding Wheels, write, wire or phone Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.

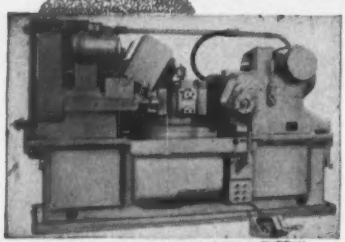
FREE BOOKLET. Now available to industry is a new booklet entitled "A New Concept In Grinding Wheels." It contains valuable information for everyone interested in grinding operations. A copy is yours for the asking. Just write Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

TRUE VALUES of grinding wheel wear are obtained by instrument which gives consistent measurement of changes in wheel radius within .00005".

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

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Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
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Ottemiller, W. H., & Co., York, Pa.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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(*Continued on page* 332)

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The needs of industry for close tolerance high production grinding on both civilian and defense items are met by our standard and special grinders. Today the line includes:

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CONTOUR-MATIC CONSTANT DIAMETER GRINDING WHEELS
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If you are not satisfied with your grinding production — your accuracy — your costs — tell us what your problem is and let us tell you, out of our experience what improvements will result from the use of our equipment.

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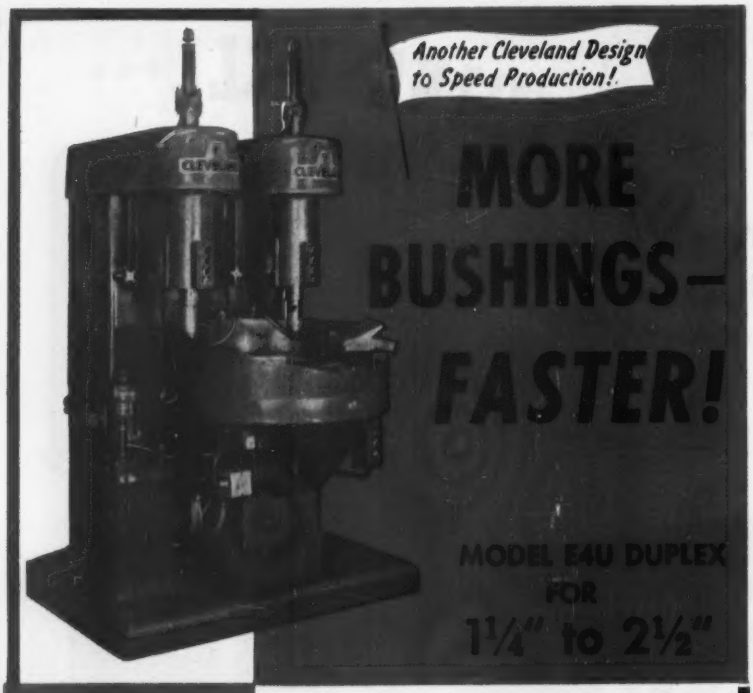

To get maximum speed on larger bushings Cleveland designed this Duplex machine with a 6 station hydraulic table. It will drill and tap 1¼" to 2½" bushings with a production of 730 pieces per hour of the 2½" size at 100% efficiency. Production of smaller sizes is of course considerably higher.

Like all Cleveland Tapping Machines it utilizes the now famous precision lead screw feed that assures you of more perfect pieces at top speeds. The result is lower costs.

Keep in mind that over the years Cleveland engineers have been designing special tapping machines to meet a varied range of requirements, often combining several operations in one machine. This accumulated know-how can be put to work for you. A machine designed by Cleveland engineers to meet your special requirements will definitely result in lower production costs.

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CANTON 6, OHIO

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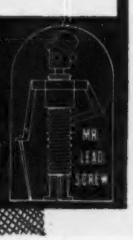
CLEVELAND lead **tapping machines** screw



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(Continued on page 334)

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THERE'S AN Onsrud® MILLING MACHINE

to do the job better ... in far less time

For aluminum milling ... in aircraft as well as other non-ferrous metalworking ... Onsrud milling machines have proved themselves faster, more accurate, and lower in cost per part produced. Completely dependable in high speed production and constant service, Onsrud milling machines have literally become the "work horses" of the aircraft industry. Features include high horsepower, high speed cutter heads ... fast feeds ... and full adaptability to meet the processing requirements of the most complex aircraft part. For any production problem in aluminum milling, the sure solution is an Onsrud machine. Your inquiry is invited.

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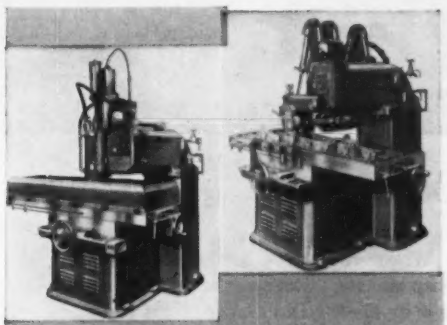

Onsrud A-24 Horizontal and Vertical Milling Machines. For general milling. High speeds, fast feeds. Precision.

Onsrud InvOmil* A-72 Profile Milling Machine. The most unusual machine in metalworking. Up to 500% faster. For high speed, heavy duty profile milling, taper milling and related milling machine operations.

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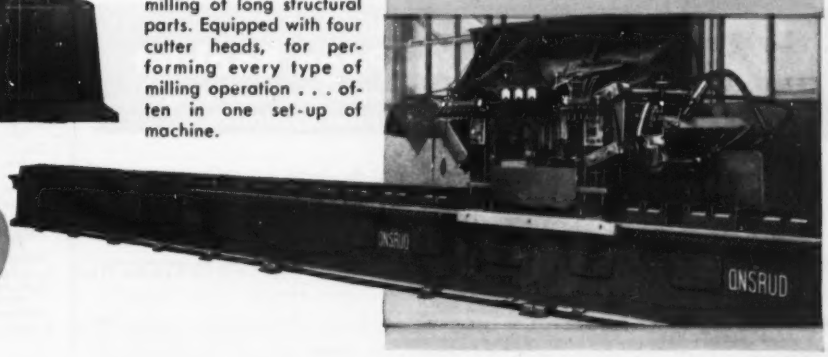

FOR HIGH SPEED NONFERROUS METAL MILLING
Onsrud
HI-FEED HI-SPEED MACHINES

KELLER Air Tools

for high speed assembly

ANOTHER EXAMPLE OF
KELLER *Air Tools engineered to industry*

Wherever parts are assembled with screws, nuts, bolts or rivets, the use of Keller Tools speeds up production, reduces costs, and makes work easier.

For example, in assembling record players (shown above), changing to Keller Air Tools made the work easier and faster, and substantially reduced production costs.

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Wide variety of handles, gearings, torques, speeds

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(*Continued on page* 336)

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"... that industrial equipment
which has maintained
high excellence in manufacture
will continue to be sold,
and will contribute its worth
to uplifting the general
quality of everything produced
in industrial America ..."

1,500 ton hydraulic press designed specifically for high-speed, heavy-duty die forging and ingot cogging.
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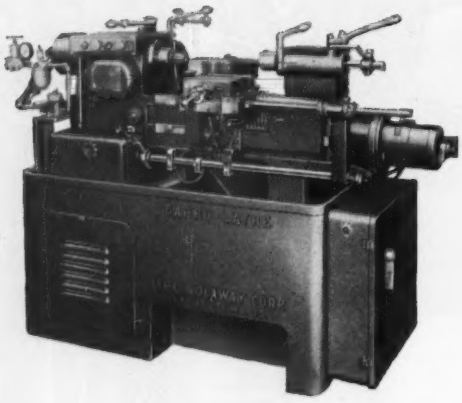
to take heavy, high-speed cuts on high-Brinell and tough steels



Swing over bed—12"
Swing over cross slide—7"
Distance between centers—18"
Floor Space—31" x 51"
10 H.P. Motor
Feeds—.003" to .030"

Faster, more accurate with carbide tools

LIPE Carbo-Lathes

with complete cycle electrically controlled

Bed and headstock cast in one piece from 500 pounds of chrome-molybdenum-iron! Massive tailstock with a 3" diameter quill! Heavy bed sidewalls reinforced by cross ribs! These are the reasons why the Lipe Carbo-Lathe eliminates all deflection and weaving — why it is rigidly resistant to torsional stresses and strains.

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More, the complete cycle can be electrically controlled. A push on the starter button starts the spindle, moves the carriage to the cutting position, automatically engages the mechanical feed. At the end of the cut, the feed disengages, the spindle stops and the carriage returns quickly to the loading position. At every point in the cycle the operator has complete manual control.

Bring Your Present Lipe Carbo-Lathes Up to Date...

Lipe automatic cycle attachment may be applied to any Lipe Carbo-Lathe bearing a serial number of 200 or greater. See your Lipe distributor for full details.

Lipe Carbo-Lathes are sold with or without Automatic Cycle Attachment. Write for further information and delivery dates.

Lipe-ROLLWAY CORPORATION
Manufacturers of Automotive Clutches and Machine Tools
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Johnson Bronze Co., New Castle, Pa.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

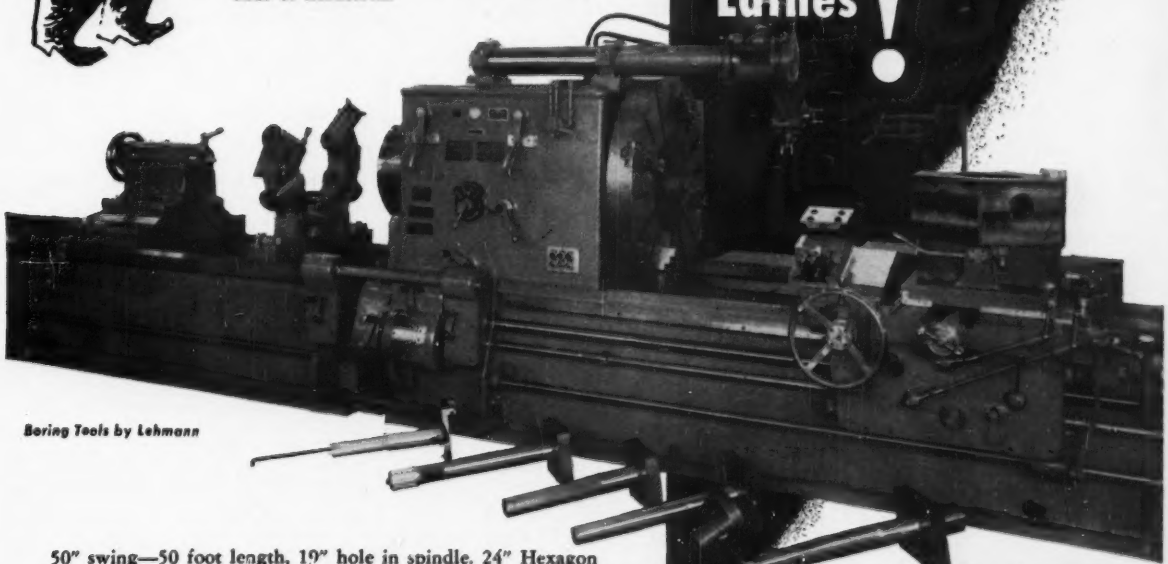
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(*Continued on page* 338)

But Boss and workers agree that you get amazing new efficiency with these

LEHMANN Large Hole DOUBLE-ENDER Hydratrol Lathes!

42" swing, 16 foot bed, 18" hole in spindle —Special headstock for short work piece. Semi-automatic multiple, longitudinal and cross feeds hydraulically operated on both ends of headstock.



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Double End Hydratrol Lathes are built in sizes from 18" with holes up to 7⅛" to larger sizes with holes to suit the job. Double End operations avoid necessity for resetting the work, and insure relative concentricity of boring and turning operations and squareness of faces at both ends.

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Type 200—4-7/8" to 8-1/16"

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Turn work piece away from jaws — Turn hood until index snaps in

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Millers Falls Co., Greenfield, Mass.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

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Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930-44 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

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Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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American Non-Gran Bronze Co., Berwyn, Pa.
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American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

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Bethlehem Steel Co., Bethlehem, Pa.
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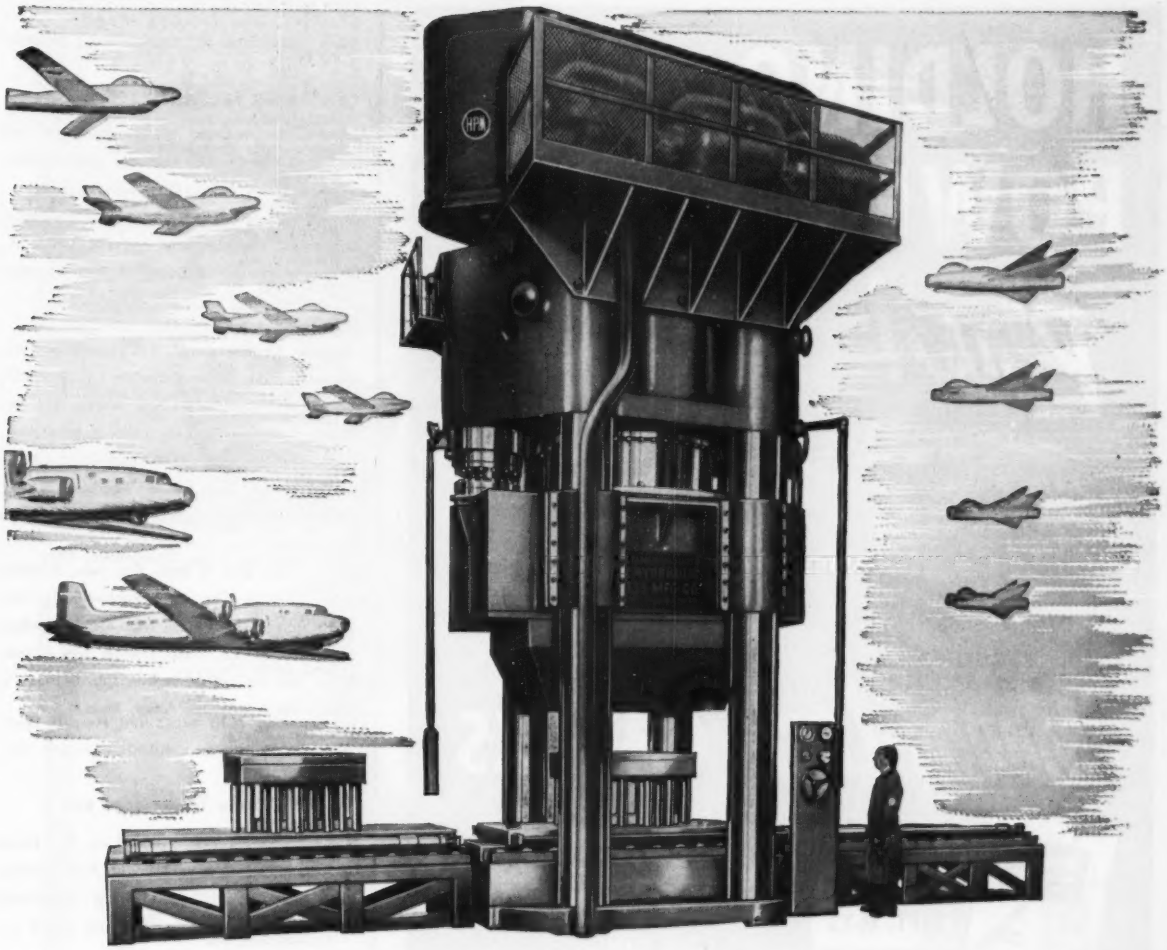
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave Pittsburgh, Pa.

(*Continued on page* 340)



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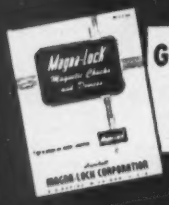

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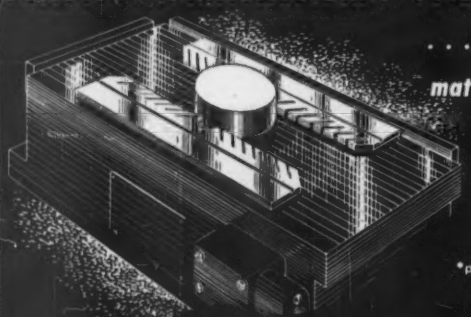

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
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Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

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Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., (Multiple Spindle), Kennsington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 342)

DOUBLE CIRCLE CARBIDE TOOLS GIVE extra service

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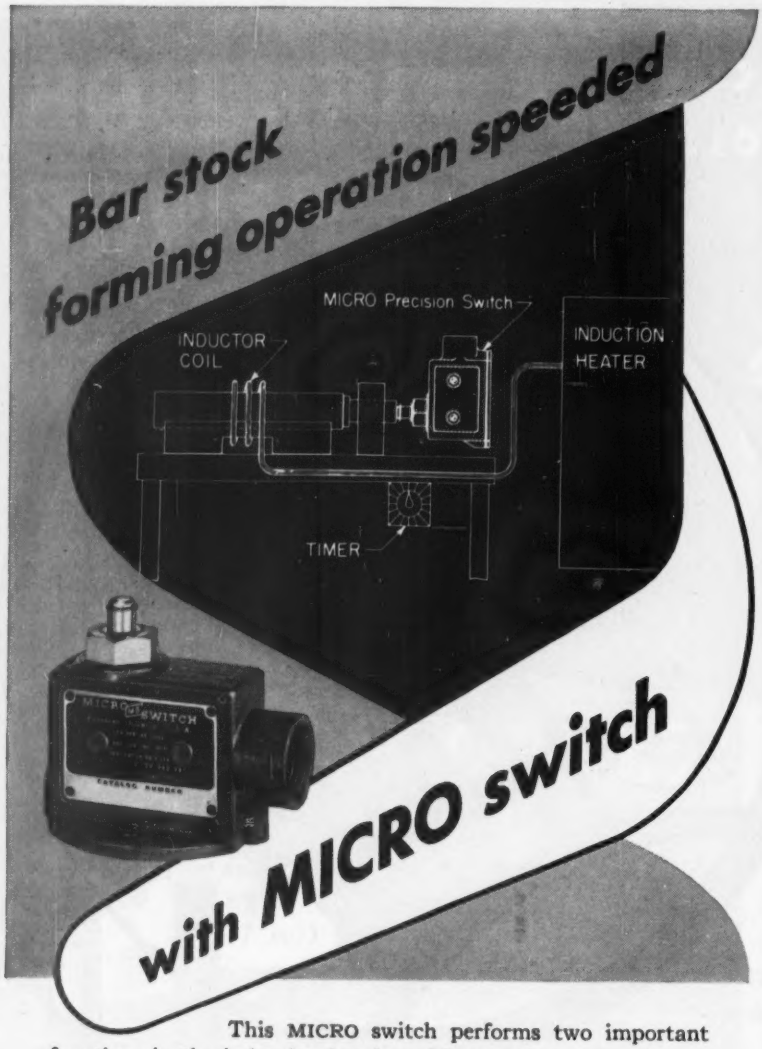

This MICRO switch performs two important functions in the induction heating of bar stock to form harrow teeth. It controls both heating and bar position.

Operator slides the bar down a grooved surface through a back stop until it contacts the switch plunger. This assures the proper position of the bar in relation to the induction heating coils. The switch then actuates a timer which starts the heating cycle. One man thus performs both the heating and pulling operations with utmost efficiency.

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MAKERS OF PRECISION SWITCHES
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See Collets

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CHUCKS, Drill
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ettco Tool Co., Inc 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Horton, E., & Son Co., Windsor Locks, Conn.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, Etc.
Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Skinner Chuck Co., 344 Church St., New Britain, Conn.

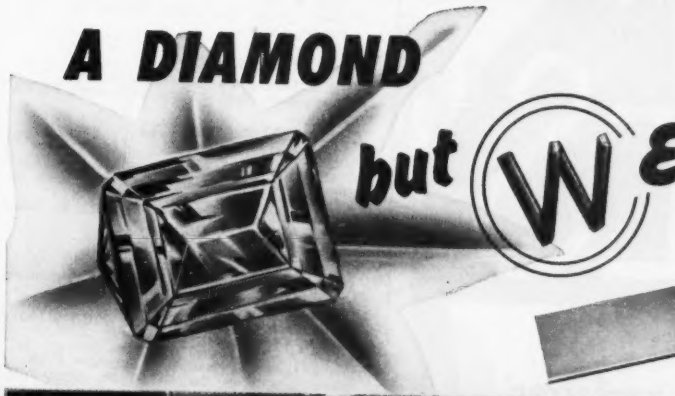
CHUCKS, Quick Change and Safety
Clarkson, Inc., 320 Ontario St., Toledo, O.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

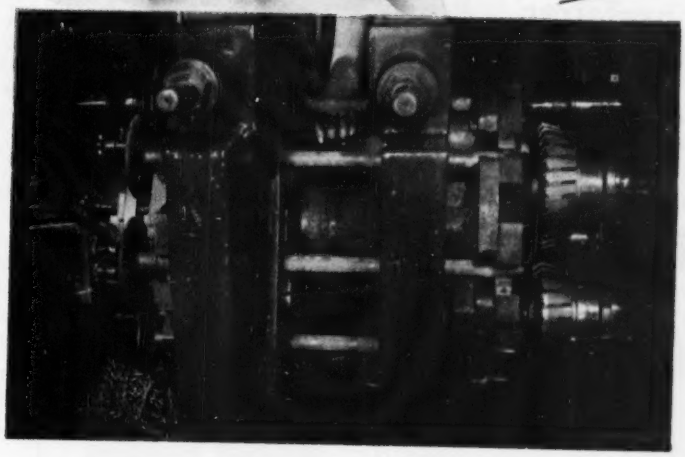
CHUCKS, Ring Wheel
Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.

(*Continued on page* 344)

THERE IS NOTHING HARDER THAN A DIAMOND but WESSONMETAL IS TOUGHER!





ACTUAL JOB
Large Automobile Plant

Machine.....Davis Thompson Milling Machine
Part.....Rear axle shaft
Operation....Rough and finish mill spline end
Material.....S.A.E. 1038–Brinell Hardness 179-229
Tools.....Wesson 6" and 8" dia. Milling Cutters–fine pitch–inserted blade
Speed.....8"–387 S.F.M.
6"–290 S.F.M.
Feed.....14" per minute
Production...150 pcs. per hour
1500-1700 pcs. per grind
Grade of Carbide....Wessonmetal WM

SAVINGS OF OVER $14,225 PER YEAR ON ONE MACHINE WITH ONE SET OF WESSON TOOLS

OLD METHOD	NEW WESSON ENGINEERED METHOD
Cost 1 set Inserted Blades.....$48.00	Cost 1 set Inserted Blades.....$54.60
Pieces per Grind.....275	Pieces per Grind.....1600
Grinding Hours per year.....10,300	Grinding Hours per year.....2500
5 Machines Running 3 Shifts	3 Machines Running 2 Shifts
Machine Repair per year.....$25,000	Machine Repair per year.....$1200
Tool Cost per Piece.....$.00545*	Tool Cost per Piece.....$.00213*

(Machine repair and grinding costs not included)

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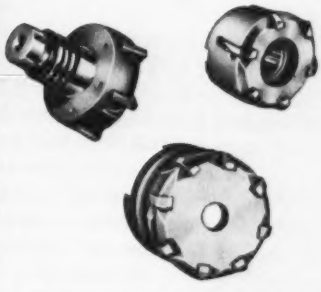

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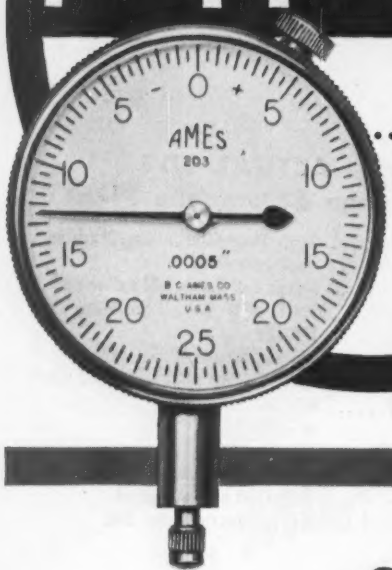

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Ames Dial Depth Gauge No. 11C

Ames Dial Micrometer No. 517

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Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave, Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

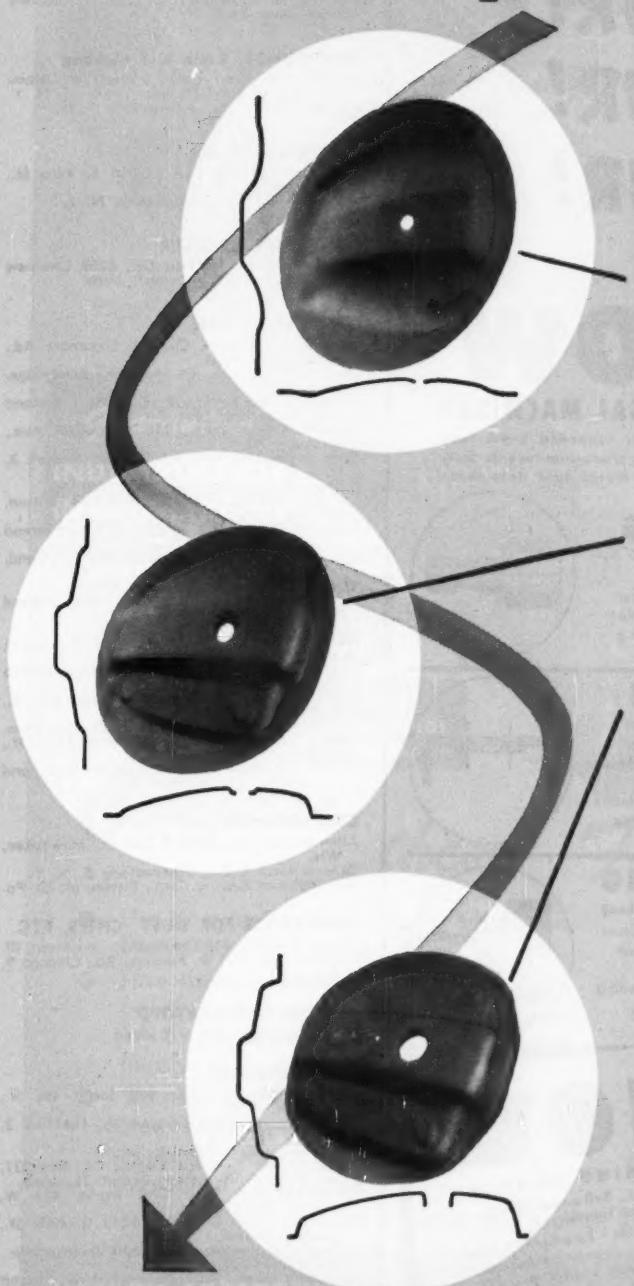
COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

(*Continued on page* 346)

the ABC of improved deep drawing: Absolute Blank Control

...and only the Hydroform has it!



ONE CONTINUOUS DRAW

Solid lines below and to the left of each view represent the horizontal and vertical sections on centerline at that point in the draw.

Shown are three views of *one continuous draw* —the Hydroforming of an appliance base from a 12" blank of .074" cold rolled steel. Hydroforming permits stopping the forming action and examining the part at any point in the draw.

Note, in the initial phase of the draw, that the Hydroform's flexible die member holds the outer edge of the blank flat on the draw ring, yet causes the center area of the blank to move quickly into contact with the punch ahead of the draw. This is the result of the complete blank control provided by the Hydroform and is not obtainable in conventional dies.

As the draw progresses, the material continues to be formed to the contour of the punch. That portion of the blank previously formed has been clamped to the punch surfaces, preventing further stretch or thin-out.

At the end of the stroke, high pressure and the edging control feature combine to finish form the part, complete with extruded hole and sharp flange radius, in this single drawing operation.

These illustrations show the Hydroform's infinite, accurate control over the blank during the entire (single) drawing action. The material is made to "hug" the punch progressively throughout the draw. With absolute blank control, Hydroforming makes possible more complex forming and deeper drawing in a *single* operation than conventional methods allow. Plan now to invest in new methods for cost reduction and product improvement. Investigate Hydroforming! Call in a Cincinnati Milling field engineer. For a description of the *five* sizes of Hydroform machines, write for Bulletin M-1759-2.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

Hydroform

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production

SNOW

FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C"T" Sink 1/16" Hole

Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING

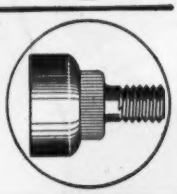
Tap Two #10-32 Holes

Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING

3/8"—24 Thread—1/2" Long

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

Submit Sample Parts fo

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435 Eastern Ave., Bellwood, Illinois
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Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

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Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).
Oakite Products, Inc, 19 Rector St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York.
Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St. Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster Ohio.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

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General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONVEYORS FOR DUST, CHIPS, ETC.

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Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant

COUNTERBORES

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Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

(*Continued on page* 348)

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WESSON'S NEW HEAVY-DUTY HUSKI-CUT

FINGER GRIP HOLDER

SHORTER CLAMPING GIVES AVERAGE OF 70% MORE TIP REGRINDING!

Guaranteed **INDESTRUCTIBLE IN ORDINARY USE**

Compare these Features!

- **Use Heavier Feeds — Higher Speeds on heavy-duty and extra-heavy-duty jobs.**
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- **Simple design — only 5 parts. H.S. Steel Anvil replaceable at low cost. No exposed clamps to wear. Use only 1 wrench all adjustments.**
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- **Solid Wessonmetal cemented carbide insert semi-standard with formed clearance angles. No slotted carbide to crack. No brazing of tips. Length of cutting edge constant.**
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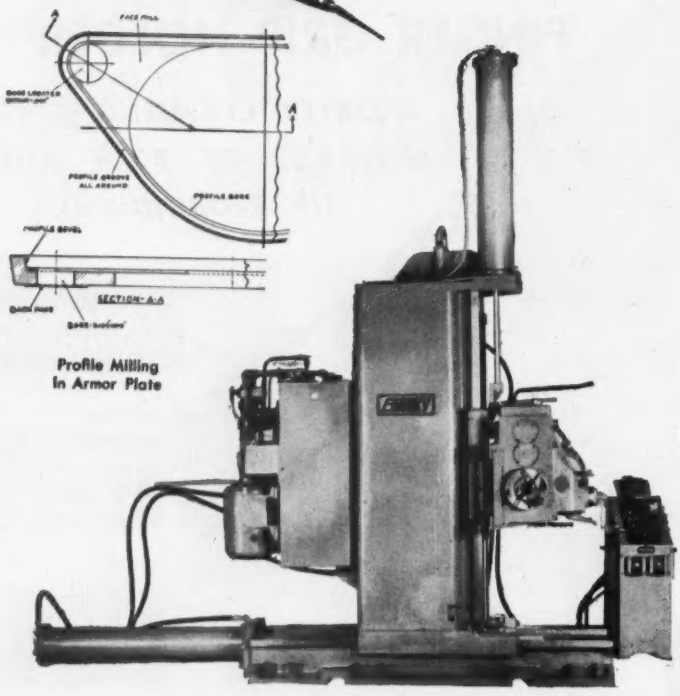
WITH YOUR COMPLICATED PROFILE MILLING AND BORING PROBLEMS



Profile Milling In Armor Plate

—UNRETOUCHED PHOTOGRAPH

Intricate profile milling and boring jobs on aluminum or magnesium castings are strictly routine when done by a Forney complete "package", ready to run, profile boring and facing machine. Forney machines are specially engineered for aircraft and armored vehicle parts work.

Whether you make spars, rib chords, fuselage bulkhead segments, wing ribs, wing hinges or other structural items you will make them better for less with a Forney machine. The same is true if you machine parts for armored vehicles.

These double-duty, custom made machines may be equipped with any type duplicator equipment with templates. A spindle housing as a motor power unit moves directly into the work face. This results in more accurate work, more power and rigidity in the cutting tool. Top quality work holding fixtures, tooling and floor plates are also available. Write or phone us today. Forney engineering consultants are ready to serve you immediately upon receipt of your drawings.

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Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Peck, Stow & Wilcox Co., Southington, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
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Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

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Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Southwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

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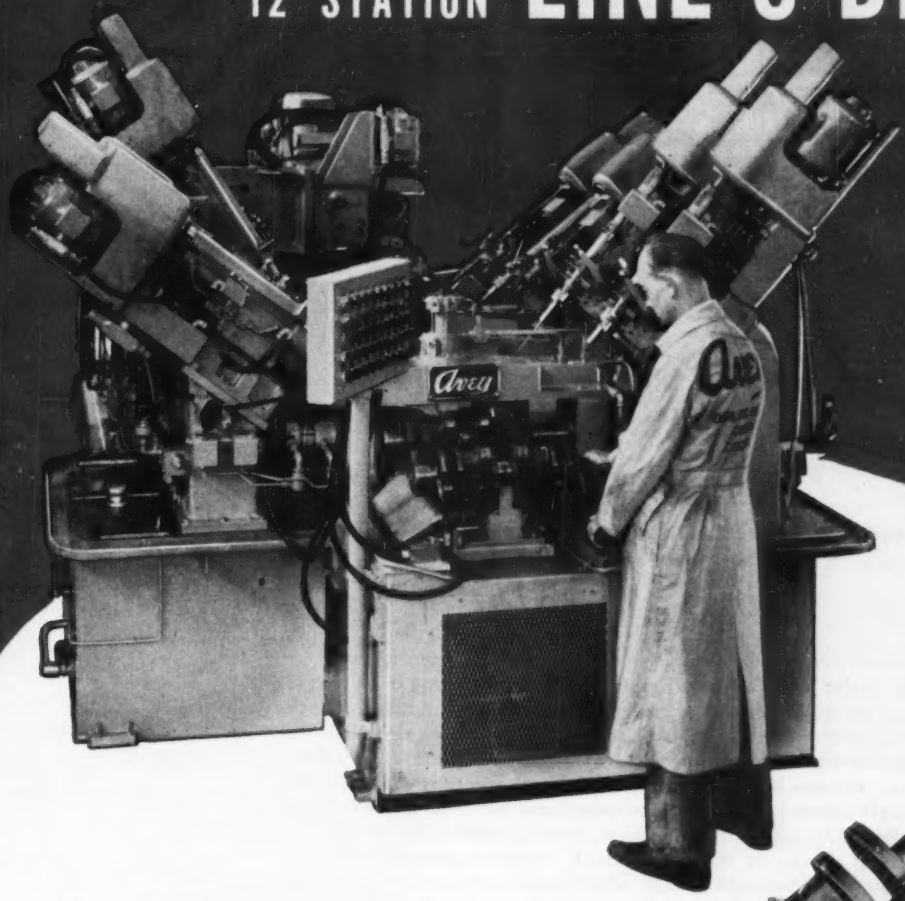
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.

(*Continued on page* 350)

60 tractor crankshafts per hour with

Avey 12 STATION LINE-O-DEX



12 Station Transfer Machine—Hydraulically operated indexing mechanism—operations include drilling all angular oil holes plus connecting metering holes. Machine incorporates all Avey-draulic Torque-matic Units for Deep Hole Drilling with Avey Cam Units and Drill Heads for Meter Hole Drilling. Machine conforms to J.I.C. Standards.

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for drilling... tapping... production machines

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Cincinnati 1, Ohio

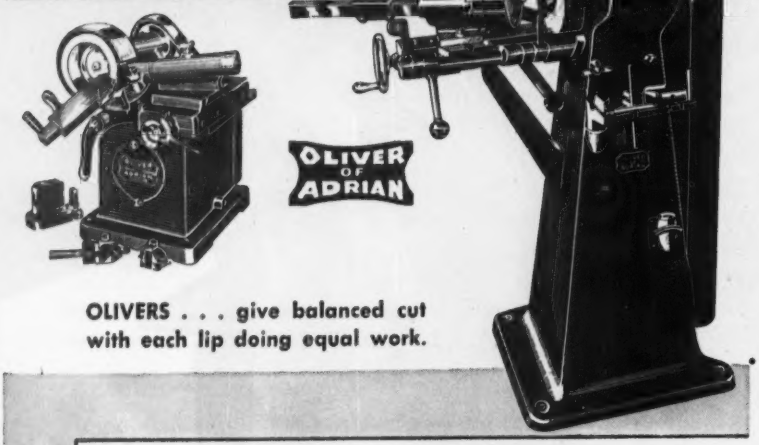
Dull Drills Are Costly!

Tests run recently to determine the cutting efficiency of drills at varying degrees of sharpness proved conclusively that, when properly machine-ground, twist drill life is increased about 300%.

OLIVER DRILL POINTERS

Reduce Drill Costs

Increase Drill Life



OLIVERS . . . give balanced cut with each lip doing equal work.

If you're wondering whether machine grinding drill points has an advantage over the old hand-grinding method, check the results of this test run recently to improve drill life: In operating hand-ground drills at a surface speed of 100 feet per minute in cast iron material, an average of only 99 cubic inches could be drilled effectively per tool. After drilling about 175 cubic inches of stock, hand-ground drills *completely broke down*. At the same speed, machine-ground drills removed an average of *450 cubic inches*—an increase in productivity of more than 4½ times over hand-grinding! To obtain *best* results with your drills, it is essential to use correctly sharpened drills. Avoid excessive drill costs and imperfect drill holes by machine-grinding on Oliver Drill Pointers—so your drills will cut faster, last longer and produce more accurate holes.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.

No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
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CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
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Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
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Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.

(*Continued on page 352*)

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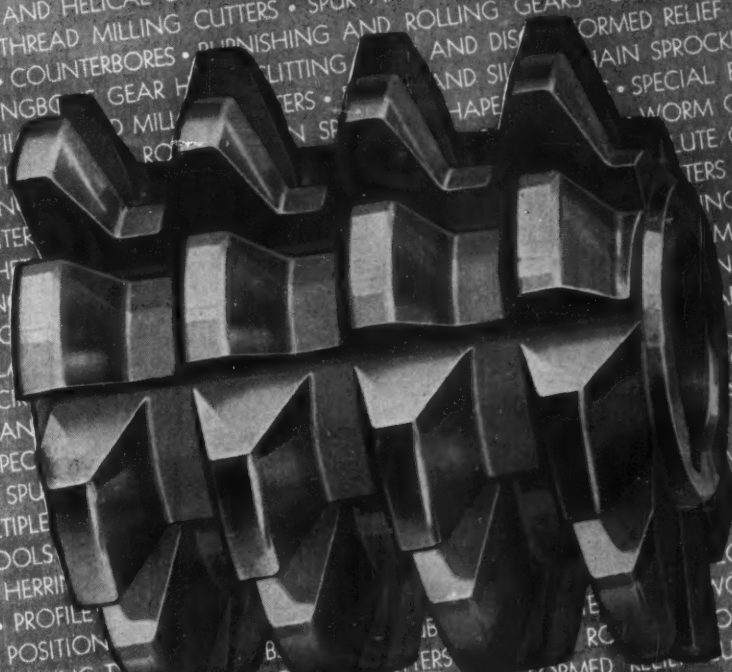
...DEPEND ON

National Tool Co.



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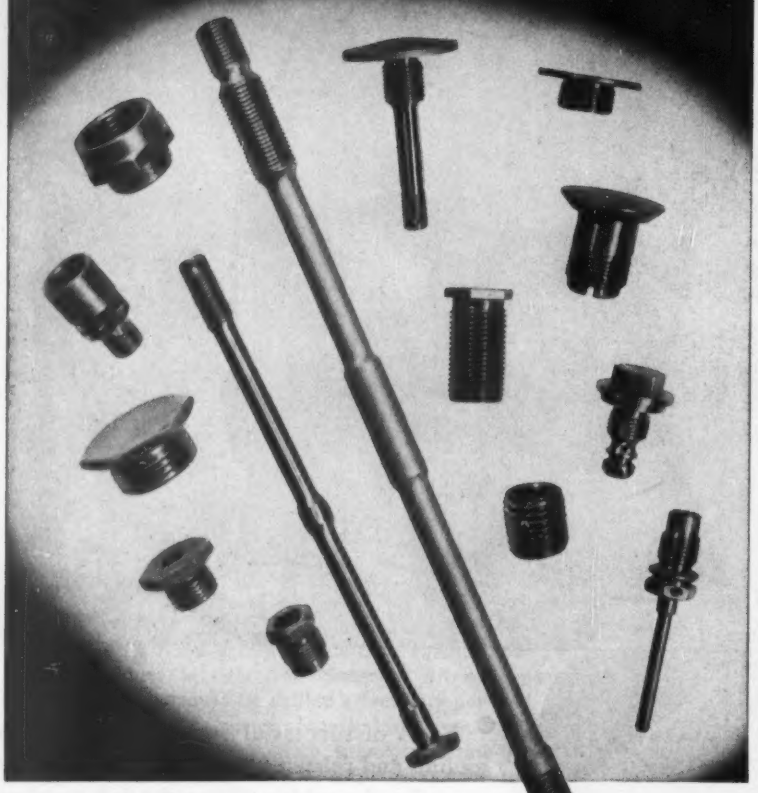
TOOL CO.
Cleveland 2, Ohio

Rolling Precision Aircraft Parts on REED Cylindrical Die Thread Rollers



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The cold forging action of thread rolling produces a thread that is substantially stronger and tougher than similar threads produced by other processes.

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Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
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Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

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Consolidated Mch. Tool Co., Rochester, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
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Consolidated Mch. Tool Corp., Rochester, N.Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Hannafin Corp. 1101 S. Kilbourn Ave., Chicago.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

(Continued on page 354)

HERE'S WHY and WHEN

Four of the complete line of Hannifin lever-type Air-Operated Presses that include over 30 basic models in capacities up to 18 tons.

WE RECOMMEND

HANNIFIN AIR PRESSES

. . . ***for Production Operations*** involving assembly, marking, staking, riveting or punching of small parts. Hannifin ½ and 1-ton air presses are fast, safe and economical . . . in both initial cost and operating cost.

. . . ***for Bigger Pressing Operations*** where infrequent use would not warrant the purchase of a hydraulic press. Hannifin lever type air presses are low in first cost . . . assure efficient, uniform work . . . are far more economical to operate than out-moded manual presses.

Select the press you need from the complete Hannifin line of air presses. All operate off ordinary shop air supply. There are over 30 basic models from which to choose, many for either bench or floor mounting. Capacities range from ½-ton to 18 tons . . . ram strokes up to 15 inches . . . daylight to 46 inches . . . reach to 12 inches.

Hannifin Series M ½ and 1-ton Air Presses. Supplied with or without electric valves for push button operation.

Hannifin Series A ½ and 1-ton Air Presses. Notice these have adjustable gap.

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HANNIFIN

Hydraulic Presses • Pneumatic Presses • Hydraulic Riveters
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Please send me Bulletins 250, 251 and 252 on Hannifin Air Presses.

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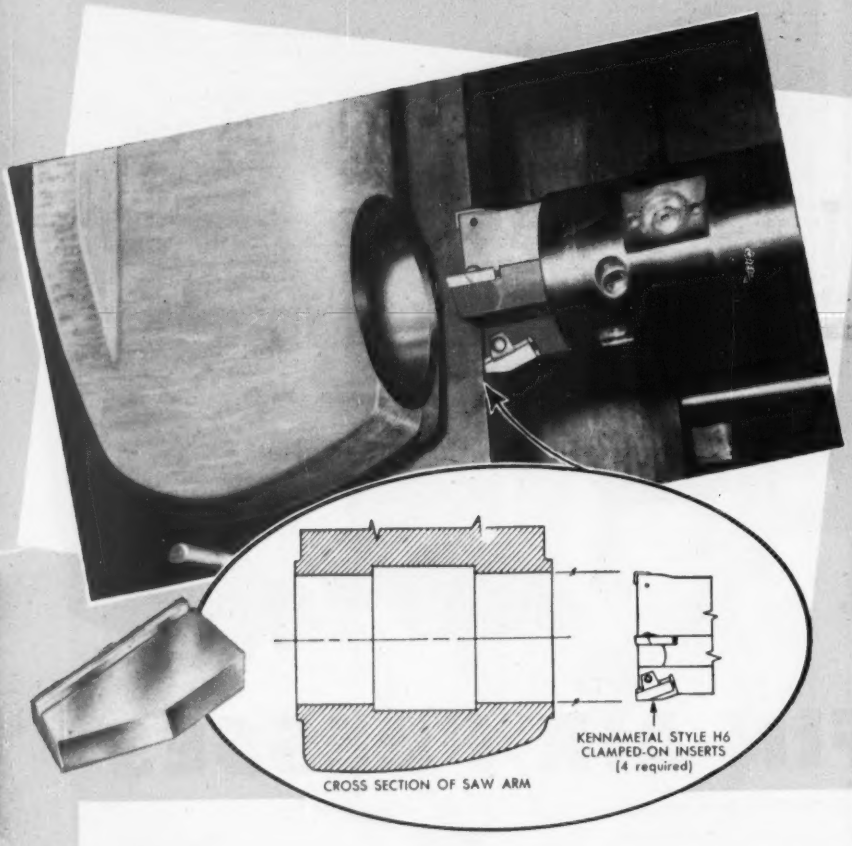
How to make A BORING JOB LESS BORING



Time, cost, and trouble were minimized in boring a 4.7" diameter hole in cast iron saw arms by these tooling changes:

A standard tool Style C-12 was replaced by a special boring heading having four standard clamped-on Kennametal inserts Style H6, Grade K6. Speed was increased 20% and feed doubled. Boring time was reduced 60%.

Before any tool sharpening was needed about 250 pieces had been bored. After six regrinds the inserts were advanced, this procedure being repeated until half of their length was utilized. Stubs were salvaged for tips on brazed tools.

Total life per set of inserts was 12,500 pieces — unit tool cost only 1/5¢. Obviously the job was less troublesome.

Although your machining problem is different, it also might admit improvement by use of Kennametal tooling. Our Tool Engineers will be glad to help. Kennametal Inc., Latrobe, Pa.

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CEMENTED CARBIDE TOOLING
THAT INCREASES PRODUCTIVITY
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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

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Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

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Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

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Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Wiliey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

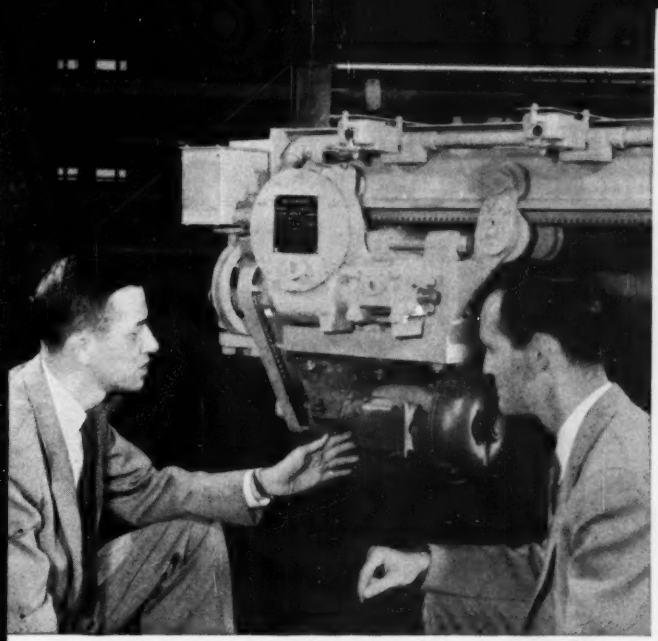
DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob Bros, Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(*Continued on page* 356)



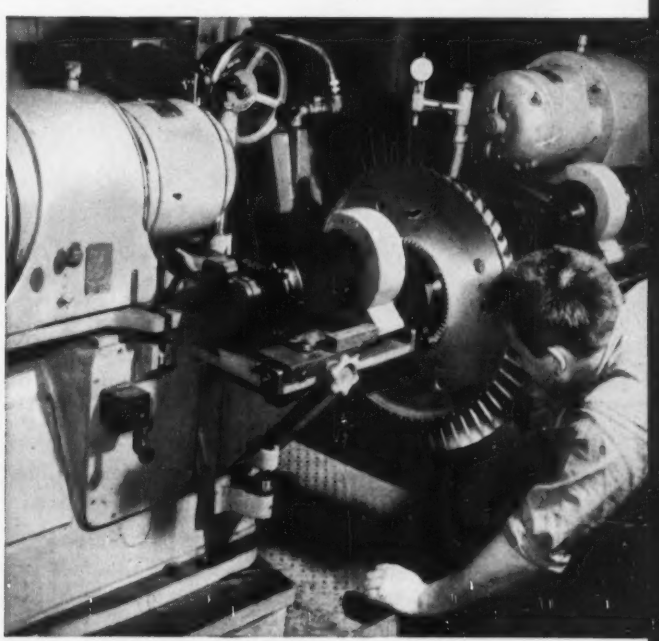
1 QUICK INSTALLATION SAVES YOU MANHOURS when G-E gear-motor is used on compact machines like this soot blower for power plant equipment. Neat, packaged construction permits quick, easy installation in limited space.

2 SIMPLE MAINTENANCE SAVES YOU MONEY. If electrical maintenance is ever needed on this G-E Tri-Clad gear-motor—driving scraper in a grannery—3-piece design will permit stator removal without disturbing gear train.

Save 4 Ways with G-E TRI/CLAD Gear-motors

REG. U.S. PAT. OFF.

3 PROMPT DELIVERY SAVES YOU TIME—assures you of getting the gear-motor you need when you need it. A new multiple point stock plan permits one-week delivery on more than 300 models of General Electric gear-motors.



4 THE "RIGHT" GEAR-MOTOR SAVES YOU TROUBLE on precision operations like grinding jet engine bucket blades. General Electric's wide selection assures you of the correct gear-motor for your particular low-speed application.

For more information about G-E Tri-Clad gear-motors contact your nearest G-E representative, agent, or distributor, or write to General Electric Company, Section 755-12, Schenectady 5, N. Y. for your free copy of new Bulletin GEA-1437H.

GENERAL ELECTRIC

UNITED AIRCRAFT chooses

Zagar engineered drilling

for J-47 Jet Engine Parts

Zagar evolves best method for drilling 383 holes in header plates and manifold for liquid-to-liquid heat-exchanger. Photographs by courtesy of UNITED AIRCRAFT PRODUCTS, INC., Dayton, Ohio.

The job: to save most time and money in drilling 365 holes .200 diameter and 18 holes 5/16" diameter. Zagar *engineered drilling* licked it.

● You, too, can profit from the often demonstrated ability of Zagar gearless drillheads to drill hundreds of holes at one pass. Zagar's engineered drilling permits record-breaking performance without drill breakage. Used alone or combined into 4-post machines, Zagar gearless drillheads drill any material and any size hole on all centers as close as twice the drill diameter. No application is too difficult for Zagar standard machines 16", 24", 32" and 40", or for special machines to fit your needs exactly. All this, at a new low cost of tooling.

Ask for Zagar Catalog "M-7".

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Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

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Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die.

DIES, Lettering and Embossing

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
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Metal Carbides Corp., Youngstown, Ohio.
Mullins Manufacturing Corp., Salem, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland,
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

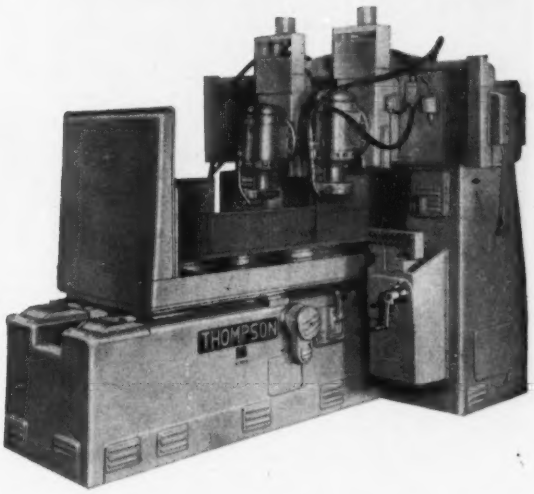
(*Continued on page* 360)

New Thompson Way Grinder Developments

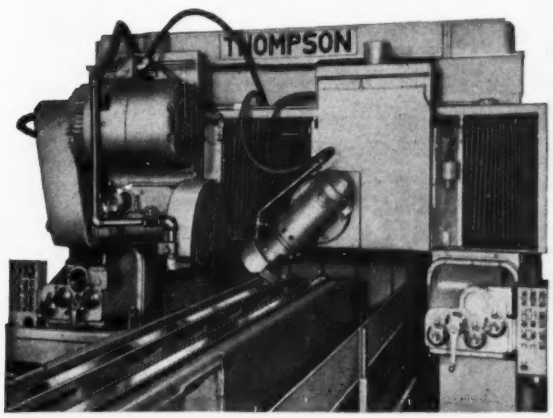
Reduce Costs ... Speed Machine Tool Production

Way Grinders now available with single, multiple heads, or combinations of horizontal and vertical heads and in sizes to meet all requirements.

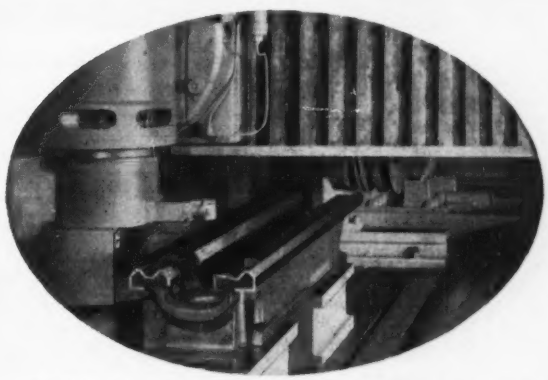
Thompson has produced machine tool way grinders in many types and sizes that have eliminated hand-work and produced economical and accurate ground ways. However, recently increased production grinding of ways has been made possible by many new Thompson Way grinding developments such as: automatic grinding and truing cycles; dual vertical or horizontal heads for grinding ways different heights; horizontal multi-wheel grinding and vertical side and undercutting head; Hydrail way grinding for giant columns or bed ways. Three of the new Thompson Way Grinders are shown here.



One of several new Thompson Double Head Dovetail Way Grinders installed to speed work and hold accuracy in the plant of a leading lathe manufacturer.



Designed especially for extremely large machine tool way grinding is this typical Thompson Hydrail Way Grinder. Size 48" x 48" x 192". Part: grinder bed ways.



Multi-wheel grinding with auxiliary vertical head. Equipped with horizontal spindle having dual spaced wheels and auxiliary inclinable spindle. The front contoured grinding wheel grinds the rear set of ways and the rear grinding wheel grinds the front set, with vertical head grinding the sides and undersurface of the ways and rack seat.

Write for details Today.

The Thompson Grinder Company, Springfield, Ohio

Thompson SURFACE Grinders

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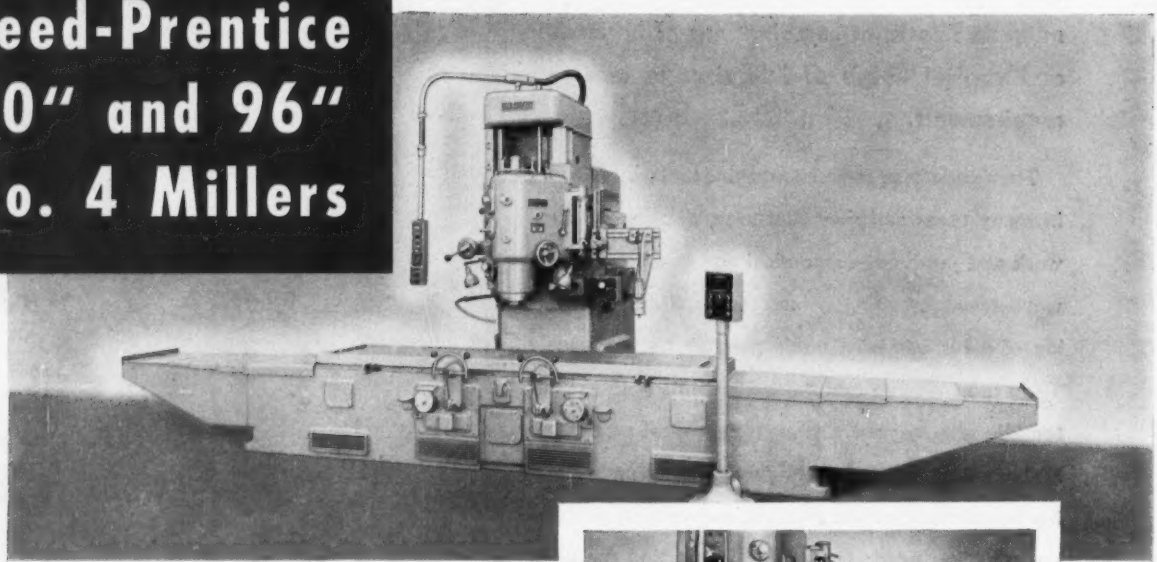
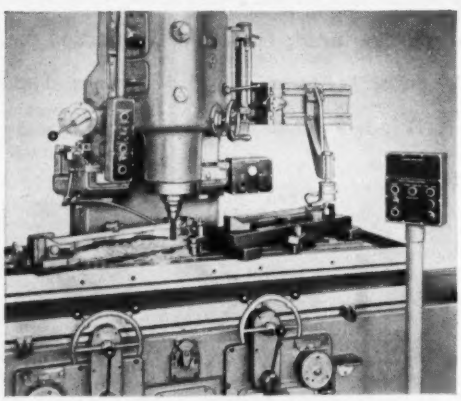
HEAVY-DUTY PRECISION PROFILING

on Reed-Prentice 60" and 96" No. 4 Millers



96" No. 4 Vertical Miller with two-dimensional Contouring Unit



Two-dimensional electronic contour follower system on No. 4 Miller duplicating aircraft part for Kaiser Manufacturing Company of Richmond, California.

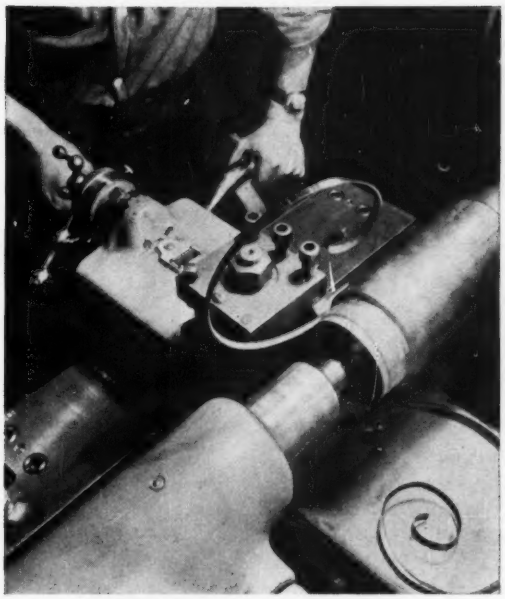
Here's the ultimate in electronic machine control — at your fingertips! The Reed-Prentice No. 4 Vertical Miller, featuring electronic control for all feeds, provides unsurpassed accuracy in complex duplicating operations when equipped with a General Electric two or three-dimensional electronic contour follower system.

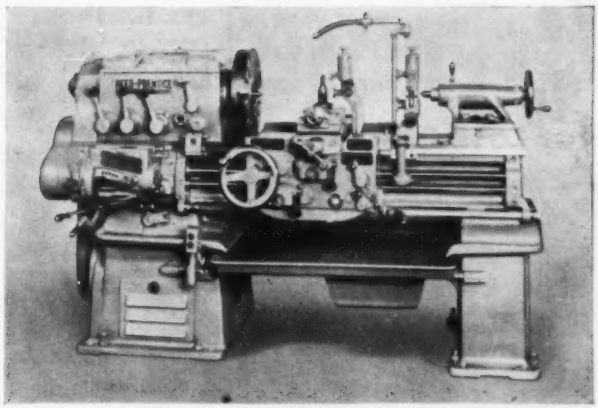
Today Reed-Prentice No. 4 Millers perform milling and profiling work for such leading manufacturers as General Motors Corp., Allis-Chalmers Mfg. Co., Chrysler Corp., Kaiser Mfg. Corp., Westinghouse Electric Corp. and National Pressure Cooker Co.

SPECIFICATIONS		#4-60"	#4-96"
Longitudinal travel of table		60"	96"
Travel of cross slide		24"	24"
Table working surface		24 x 96"	24 x 132"
Feed range		½ to 25" per minute	
Spindle speeds:	20 H.P. motor	45-1800 RPM	
	25 or 30 HP motor	90-1800 RPM	

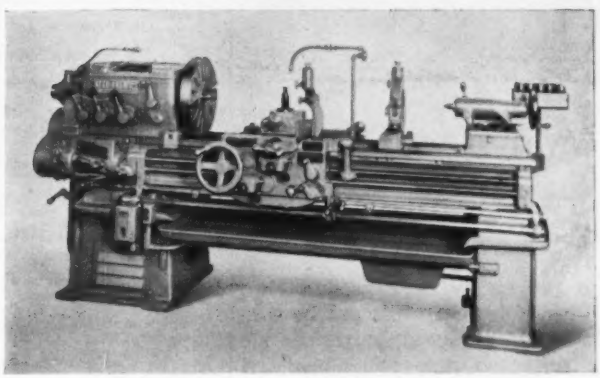
REED-PRENTICE CORP.
MACHINE TOOLS
WORCESTER MASS., U.S.A.

MAIN OFFICE 677 Cambridge St., Worcester 4, Mass.





Reed-Prentice 14" Engine Lathe



Reed-Prentice 16" Toolroom Lathe

ACCURATE **HEAVY-DUTY** TURNING on

Reed-Prentice 14", 16" and 20" Lathes

Rugged construction, improved headstock design and rigid spindle mounting add up to fast, accurate turning on Reed-Prentice Sliding Gear Head Lathes. Redesigned headstock permits heavier cuts and faster turning. Both 14" and 16" Engine and Toolroom models offer spindle speeds up to 1200 R.P.M. Distance between centers is from 30" up in 24" increments.

On all Reed-Prentice Lathes, carriage bears on front and rear vees and also on the horizontal and flat bearings. Each flat surface is adjustably gibbed for wear to insure permanent cutting tool support. Separate lead-screw and feed rod construction with safety interlock prevents engagement of feed rod and leadscrew at the same time.

Hardened steel bedways for carriage vee bearings only can be furnished on Reed-Prentice 14" and 16" Lathes. Further details upon request.

Catalog #40, containing illustrated circulars on Reed-Prentice 14", 16" & 20" Lathes, is yours for the asking.

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Chicago . . . . . DoAll Mid-West Co.
Milwaukee . . . . DoAll Wisconsin Co.
Minneapolis . . . . Chas. W. Stone Co.
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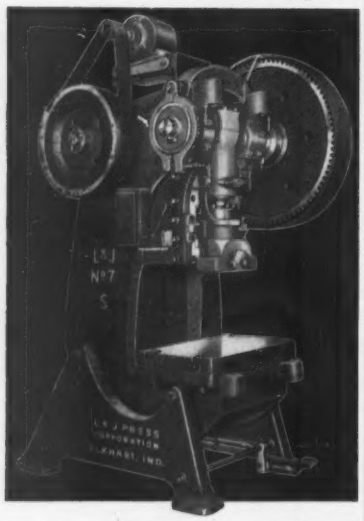
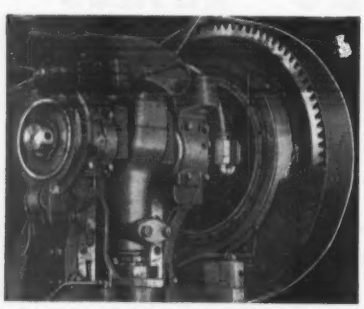
L&J PRESSES

for Low-Cost Output



The exceptional rigidity and accuracy built into L & J No. 7 Presses is proven by their productivity. Close tolerance work can be consistently produced, longer die life results from proper alignment and minimum deflection. Reports of users show down time and maintenance surprisingly low. Find out now how these presses can improve the quality and volume of your press work at reduced costs.



L&J FAWICK AIR CLUTCH

This clutch, when used with a variable speed drive, provides maximum speed for each operation. Also, more production and greater safety. L & J Air-Release Spring-Set Brake is positive, fast, safe—sets automatically if air pressure fails.

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ELKHART, INDIANA

DIES, Thread Rolling

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Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DIVIDING HEADS

See Indexing and Spacing Equipment

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio
Meyers, W. F., Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

DRIFTS, Drill

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

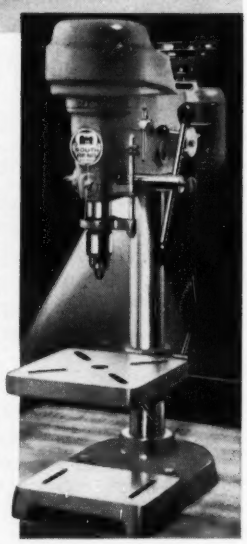
(*Continued on page* 362)

ECONOMY

14"
South Bend Economy Model Bench Drill Press

Ruggedly constructed for machine shop service. Drills to center of 14-1/4" circle. Free-floating spindle. Four precision ball bearings. Time payment plan is available.

PRECISION



For greater precision, maximum convenience and more satisfaction select the South Bend Precision Model 14" Drill Press. Has built-in work light, free-floating spindle, four precision ball bearings, adjustable quill bearing, quick-acting belt tension release. 1/3 or 1/2 h. p. vertical mounting motor required. Time payment plan available.

South Bend also makes several types of multiple spindle drill presses for production operations — write for information.

Write for catalog of 14" Drill Presses. Also, 9" to 16-24" Lathes, Lathe Attachments, 7" Shapers — specify machine interested in.

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

...with TYCOL lubricants on hand!

Heavy-duty cutting operations? Here's what happens when you switch to Tycol Afton oils! A well known Engineering Company (you'd recognize the name instantly) recently tested cutting oils used to shape 14" gears on a Gleason Bevel Gear Generator. Their findings: after the first rough cut around, with competitive oils, they had to grind a full ⅛" off the cutter. With Tycol Afton 8, they hobbed *two* gears and took off only .013". Afton oils are non-corrosive... and so stable they're widely recommended as hydraulic oils! They serve a triple function as coolants, lubricants, and hydraulic media on the same machine... the heavier the cut – the better they perform. It will pay you to find out why – by contacting your local Tide Water office!

Over 300 Tycol industrial lubricants are at your disposal... engineered to fit the job!

REFINERS AND MARKETERS OF VEEDOL... THE WORLD'S MOST FAMOUS MOTOR OIL

TYCOL
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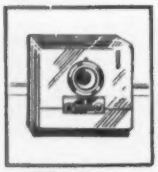
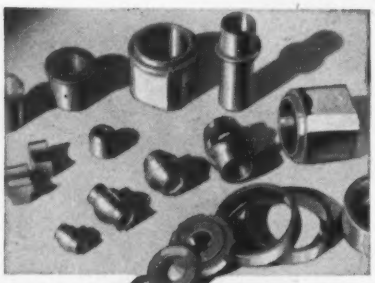
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

Ideal for certain applications



Washers

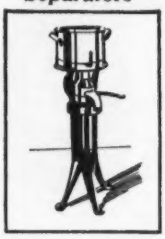


Cotton Pickers

JOHNSON
Ledaloyl
SELF LUBRICATING
BEARINGS and parts

Electric Motors

Cream Separators



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Airplanes

THESE low cost, porous, self-lubricating bearings may be the answer to some of your bearing problems. If so, you will make substantial savings. Johnson Ledaloyl Bearings and Parts are molded under high pressure from powdered metal . . . no machining necessary . . . hence the low unit cost in large quantities. Some industrial applications are: places difficult or impossible to lubricate, uses where heavy duty service is not a factor, installations requiring self-aligning bearings, and others. New uses are being discovered every month. Johnson engineers will gladly help you to determine whether you can use Ledaloyl bearings to your advantage. Write today.

Popular sizes of straight, flanged and self-aligning bearings available from stock. Write for catalog.

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JOHNSON B BEARINGS
Sleeve-Type

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Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

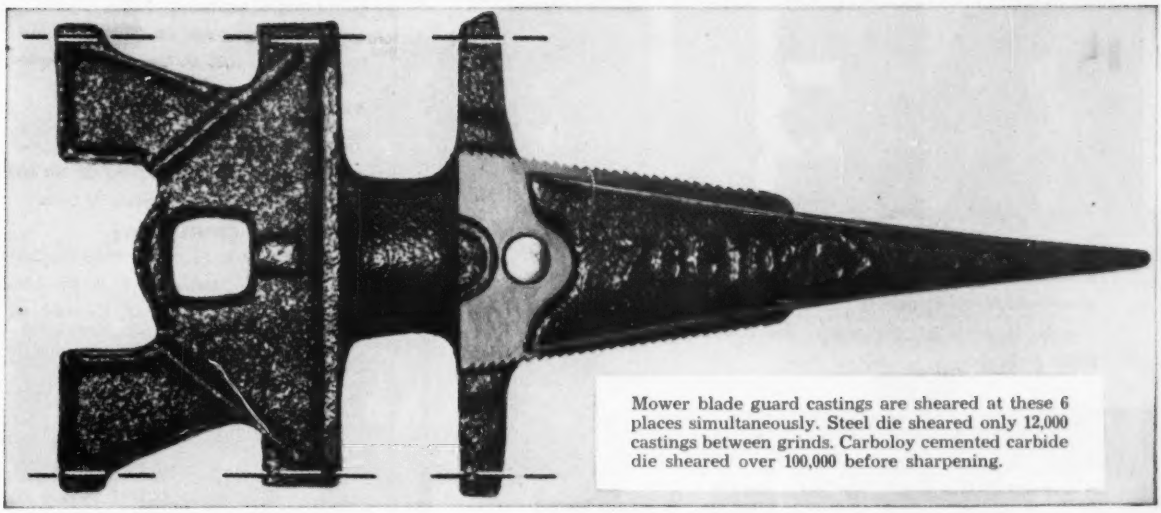
DRILLING MACHINES, Automatic

Avey Drilling Mch.. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Dumore Co., 1300 17th St., Racine, Wis.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

(*Continued on page* 364)



Mower blade guard castings are sheared at these 6 places simultaneously. Steel die sheared only 12,000 castings between grinds. Carboloy cemented carbide die sheared over 100,000 before sharpening.

OLIVER CORPORATION REPORTS—

Carbide inserts increase die life over 800%!

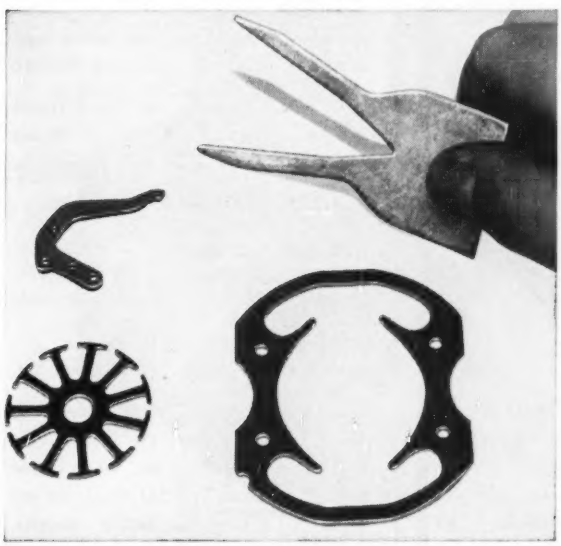
Carboloy cemented carbide on cutting edges of trim block shearing die increased production from 12,000 to well over 100,000 pieces between grinds!

WHEN THE Oliver Corporation switched from a steel die to a die equipped with Carboloy cemented carbide, things happened!

Carbide's stay-sharp-longer feature increased trim block life from one day to more than 8 days between grinds. It increased production, lowered maintenance costs, cut rejects, slashed downtime. There was no chipping or cracking of carbide under continuous impact; little grinding was needed to restore cutting edge.

Perhaps you have a die job – simple or complex, large or small – where you can get the same benefits. If so, have a Carboloy representative stop at your plant, show you how easily Carboloy cemented carbides can be profitably applied to almost any blanking, forming, drawing or piercing die.

Send coupon for free Carboloy Die Engineering Manual D-124 containing details on carbide applications.



Typical parts being produced by industry on carbide dies. Dies of Carboloy cemented carbide outlast steel dies 10 to 50 times. Produce burr-free, close tolerance parts with a minimum of maintenance and downtime.

"Carboloy" is the registered trademark for the products of the Carboloy Department of General Electric Company

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

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11147 E. 8 Mile Road, Detroit 32, Michigan

Gentlemen:
- ☐ Send me, free, your helpful Die Engineering Manual D-124.
- ☐ Have a Carboloy representative call at my plant.

Name _____ Position _____

Company _____

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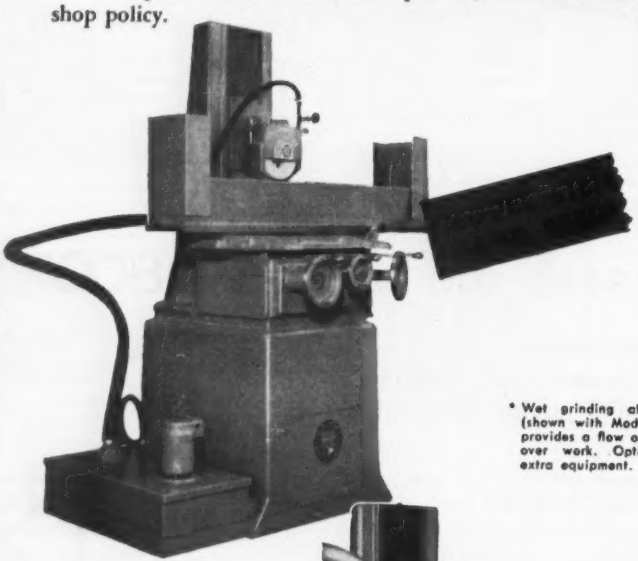
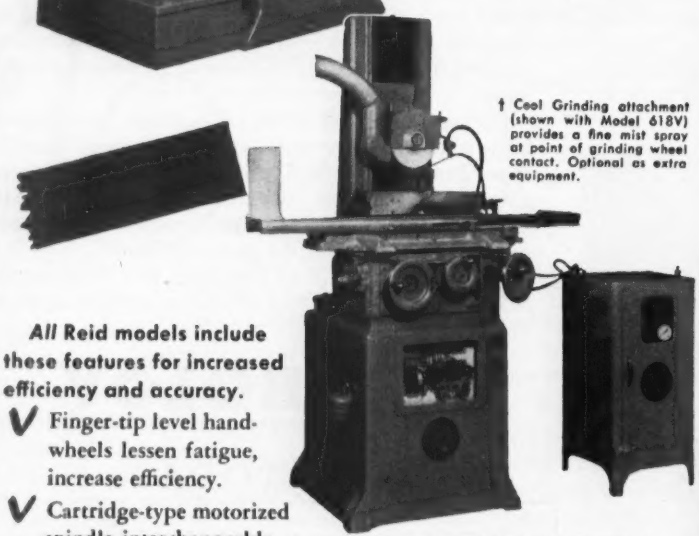
REID

It's also a fact that preference is divided between Reid models — some shops and operators give first choice to the power-table type; others prefer the hand-feed models.

It depends on the work, the operator, and sometimes just shop policy.



* Wet grinding attachment (shown with Model 618H) provides a flow of coolant over work. Optional as extra equipment.



† Cool Grinding attachment (shown with Model 618V) provides a fine mist spray at point of grinding wheel contact. Optional as extra equipment.

All Reid models include these features for increased efficiency and accuracy.

- ✓ Finger-tip level hand-wheels lessen fatigue, increase efficiency.
- ✓ Cartridge-type motorized spindle interchangeable within minutes.
- ✓ Rugged one-piece column casting mounted on base insures alignment, eliminates vibration.

Find out why REID is preferred by industry for precision grinding. For a complete description, request Bulletin 618-2.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

DRILLING MACHINES, Boiler

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Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.

DRILLING MACHINES, Deep Hole

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Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

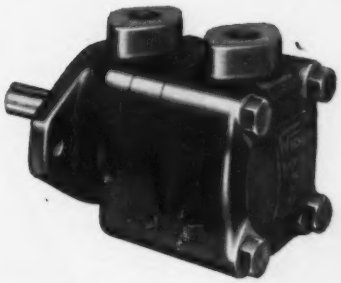
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

(Continued on page 366)

Series M2-300 Vickers Hydraulic Motors made in three sizes with 3 styles of mountings.



Series M2-200 Vickers Hydraulic Motors made in two sizes with 2 styles of mountings.

NOW AVAILABLE-

Series M2-400 Vickers Hydraulic Motors made in two sizes with 3 styles of mountings.

MORE SIZES of VICKERS BALANCED VANE TYPE HYDRAULIC MOTORS

Series M2-500 Vickers Hydraulic Motors made in two sizes with 2 styles of mountings.

Now in production are two more series of Vickers Balanced Vane Type Hydraulic Motors. They are now available in nine sizes and have normal horsepower ratings to 28.5 hp. Among the important features of these simple and rugged hydraulic motors are: (1) more horsepower for less money, (2) hydraulic balance for longer life and less maintenance, (3) automatic wear compensation, (4) dynamic balance and quiet operation, (5) exclusive "rocking beam" construction. Get in touch with your nearest Vickers Application Engineering office for further information; ask for new Bulletin M-5103.

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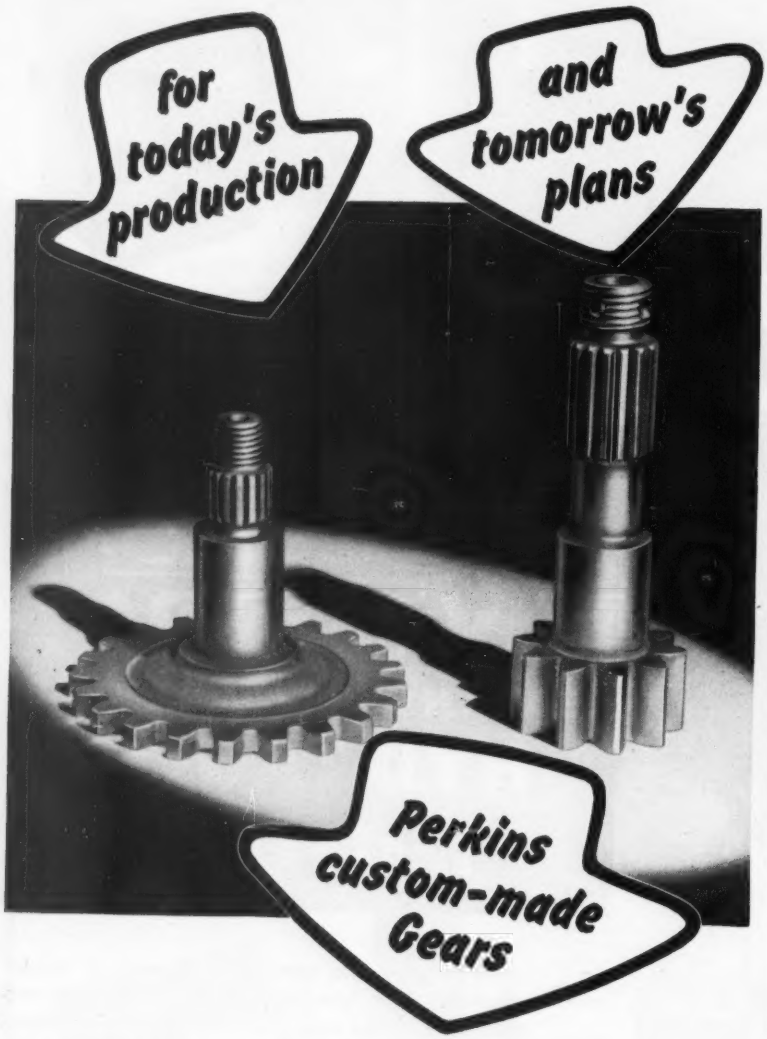
Write for NEW Bulletin M-5103

6219

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



GEAR DESIGN and manufacture in general, are ancient arts, but for the requirements of modern machines the scope of analysis, detail design, and test techniques have had to be extended far beyond the considerations acceptable only a relatively short time ago. For example, results obtained by the aircraft industry have revealed greater possibilities for the application of high power gearing.

The high speeds involved in these types of gear drives, however, create particularly strict requirements for accuracy and uniformity of the gears. And this is the very reason why before, during and since the war, the production of aircraft gears has been our number one job! But regardless of application — from aircraft to washing machines — if your product calls for trouble-free power transmission, it calls for PERKINS custom-made GEARS.

You Furnish the Specifications
We'll Produce the Gears

PERKINS MAKES:
to customers' specifications, in all materials, metallic and non-metallic: bevel gears, ratchets, sprockets, ground thread worms, spiral gears, helical gears, spur gears with shaved or ground teeth.

Have us quote on your requirements.

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WEST SPRINGFIELD, MASSACHUSETTS

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo,
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mich. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

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Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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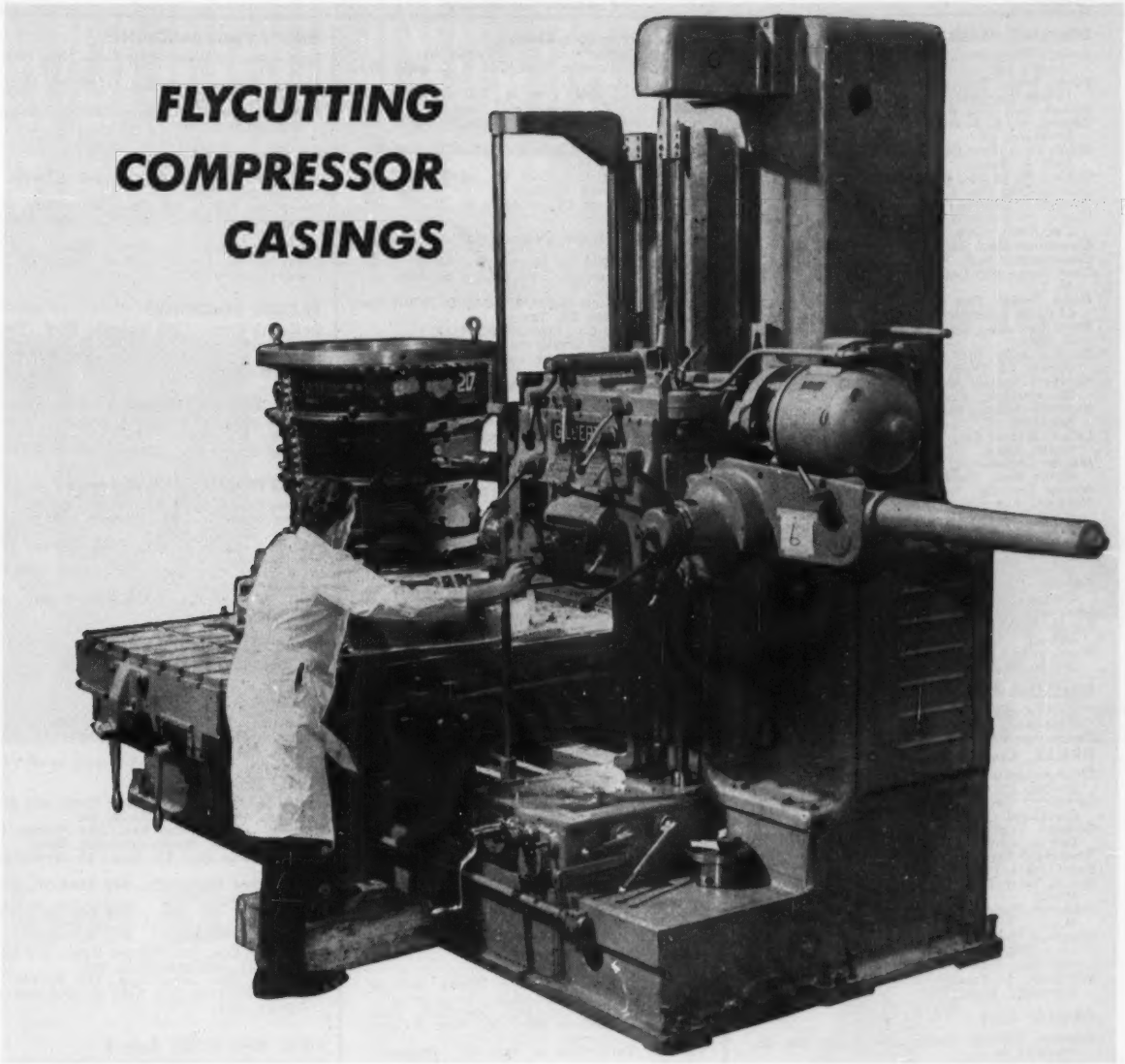


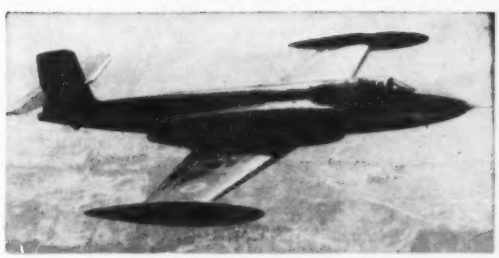
on the

ORENDA JET ENGINE

at A. V. Roe Canada, Ltd., Malton, Ont.

A total of ten Cincinnati Gilbert horizontal boring mills have been installed at A. V. Roe, and four more are on order. These fast modern machines fit the demand imposed by the Orenda Jet Engine production program: high production and accuracy in the extreme. They are delivering the kind of service that supports the statement: "Those who buy Gilbert buy Gilbert again."

Whatever your boring mill or radial drill requirements may be, you'll be well advised to investigate the productive capacity of Cincinnati Gilbert machines. Our representative is always at your service.



THE CINCINNATI

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N.Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Galring Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besly-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel.

EMERY WHEELS See Grinding Wheels.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Federal Press Co., 600 Division and Big Four R. R., Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co, Div. Emhart Mfg. Co., Hudson, N. Y.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jarvis, Chas. L., Co., Middletown, Conn.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Thor Power Tool Co., Aurora, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.

FINISHES FOR MACHINES AND METAL PARTS

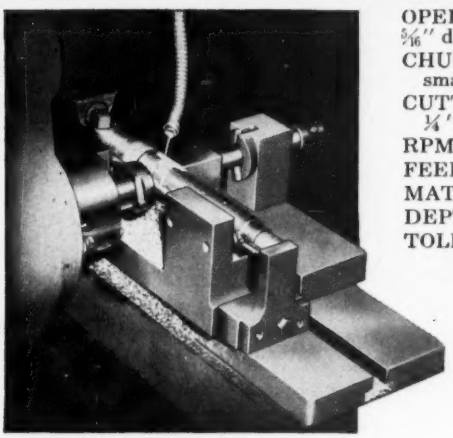
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS

See Couplings, Flexible.

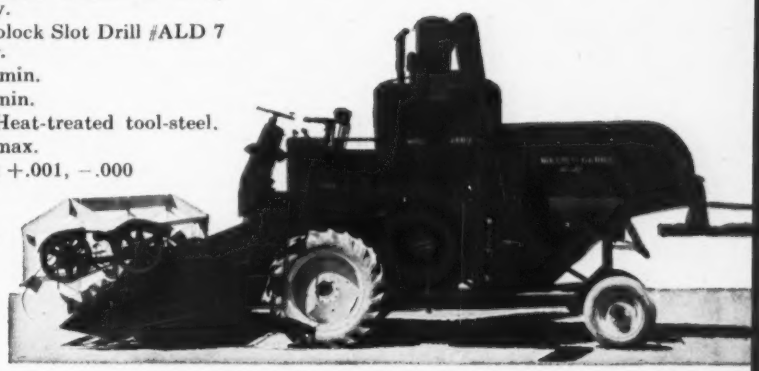
(*Continued on page* 370)

AUTOLOCK
IN PRODUCTION..



IN ONE CUT—Dead True to Size

OPERATION: Cut ¼" wide keyway 5/16" deep.
CHUCK: Autolock Chuck 40 INT, small capacity.
CUTTER: Autolock Slot Drill #ALD 7 ¼" Diameter.
RPM: 1000 per min.
FEED: 2" per min.
MATERIAL: Heat-treated tool-steel.
DEPTH: 5/16" max.
TOLERANCE: +.001, −.000



Clarkson DEDLOCK chucks

The Dedlock range of cutters is from 2" to 6" in diameter and only one Dedlock chuck is required to hold the complete range of standard or long reach Dedlock cutters.

The Dedlock cutter is fitted to the adapter in a matter of seconds, a few turns and it is ready to work.

The turn of a screw immediately releases the cutter so that the changing of cutters can be effected in seconds.

Dedlock is self locking, and under the heaviest of cuts the cutter can be released easily.

CAPACITY
2" to 6"

CAPACITY
SMALL SIZE
1/16" to ¾"
LARGE SIZE
⅞" to 1¾"

Clarkson AUTOLOCK chucks

The Autolock Chuck locks automatically. The cutter cannot slip, pull down or move up; it runs dead true and cuts to size.

The Autolock Chuck fits directly into the machine and all adapters are eliminated.

Autolock means increased feeds and speed; low tool costs; long life to the cutters; elimination of breakages; fewer production breakdowns and no spoiled work.

Clarkson INCORPORATED

DEDLOCK CHUCKS • AUTOLOCK CHUCKS • MILLING CUTTERS • CLARKSON CUTTER GRINDERS

320 Ontario St., Toledo, O.

FLEXIBLE SHAFT EQUIPMENT
Dumore Co., 1300 17th St., Racine, Wis.
Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGING (Upsetting) MACHINES
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif. (Stretch-Wrap).
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co, Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks
Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Mahon, R. H., Co., Detroit 34, Mich.

FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Alina Corp., 401 Broadway, New York 13, N.Y.
Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Pierce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Pierce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stelliite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES, Surface
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
aft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.

(*Continued on page* 372)

40 YEARS

OF LEADERSHIP

Management and employes take pride in announcing to our many friends and customers that Eclipse Counterbore Company became 40 years of age in May. From a humble beginning in 1913 to a position of leadership in 1953, Eclipse is today truly synonymous with quality in the cutting tool industry. This healthy maturity could never have been attained without the help of those same friends and customers . . . and so to them we say "Sincere Thanks."

The orginal Eclipse interchangeable single-diameter counterbore created in 1913.

A modern multi-diameter carbide tipped Eclipse Cutter.

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

Fellows Gear Shaper Co, 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.

HARTFORD SPECIAL

AUTOMATIC THREAD ROLLERS

Hartford Special Automatic Thread Rollers feature completely automatic hopper feed, vibration free operation and quick and easy setups. Model A-312-H above rolls screws from No. 6 (.138) thru 5/16" diameter with thread lengths up to 2½". Smaller model A-190-H rolls screws from No. 2 (.086) thru No. 10 (.190) with thread lengths up to 1½".

For complete information send for Bulletin TR.

When it comes to production —

HARTFORD Special

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.

Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7125 E. McNichols Rd.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave. Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

(*Continued on page 374*)

Among the many contractors who make these 50 caliber, 60 caliber and 20 m/m brass and steel cartridge cases, a few use machines that are strictly special—designs that will be practically scrap value, so far as adaptability to other work is concerned, when the shell job is finished.

Many more millions of these shell cases are now being machined on

Standard 6 Spindle ACME-GRIDLEY Bar Automatics

Some of these standard machines are equipped with magazines loaded by hand, as on the job illustrated, others with fully automatic hopper feeds—reducing man hours to minimum.

And with simple carbide tools output is fast—in fact 1.5 seconds (2,400 per hour).

* * *

WHAT'S THE PAYOFF? Just this—when the job is done, Acme-Gridleys can quickly be retooled—good for years more service on peace-time parts production. Quite a difference in investment value and long terms profit.

Whatever your specific bar automatic needs today, consider also the value of these machines tomorrow—the importance of Acme-Gridley basic universal application and modern tooling ingenuity.

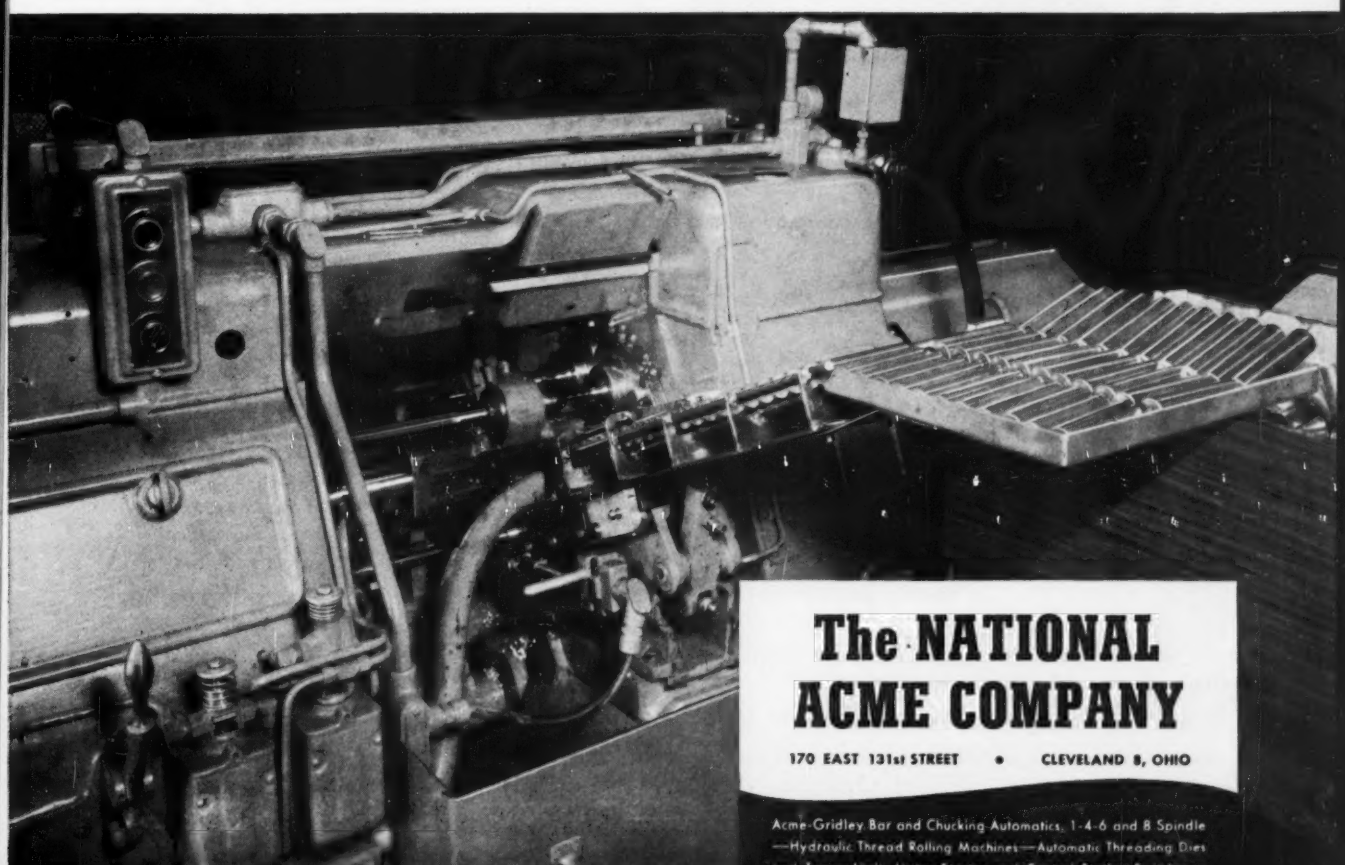
We've built more than 45,000 of them—in sizes up to 7¾" capacity.

here today...

BUT

what about tomorrow?

You can't do TODAY'S *job... with* YESTERDAY'S *tools... and be in business* TOMORROW



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

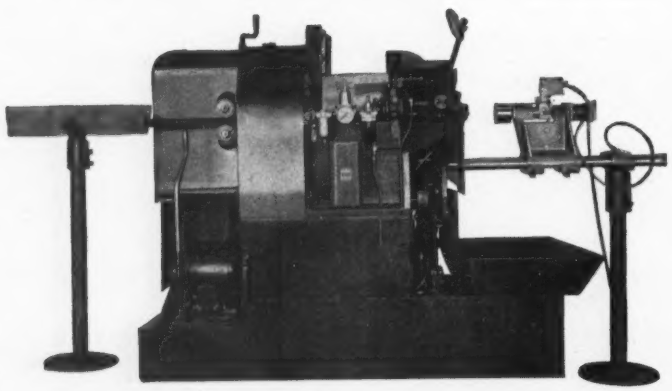
Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8 Spindle —Hydraulic Thread Rolling Machines—Automatic Threading Dies and Taps—Limit, Motor Starter and Control Station Switches—Solenoids—Contract Manufacturing.

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St. Philadelphia, Pa.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave. Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Marlemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs

Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO.
Jackson, Michigan

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Portable Electric and Toolpost

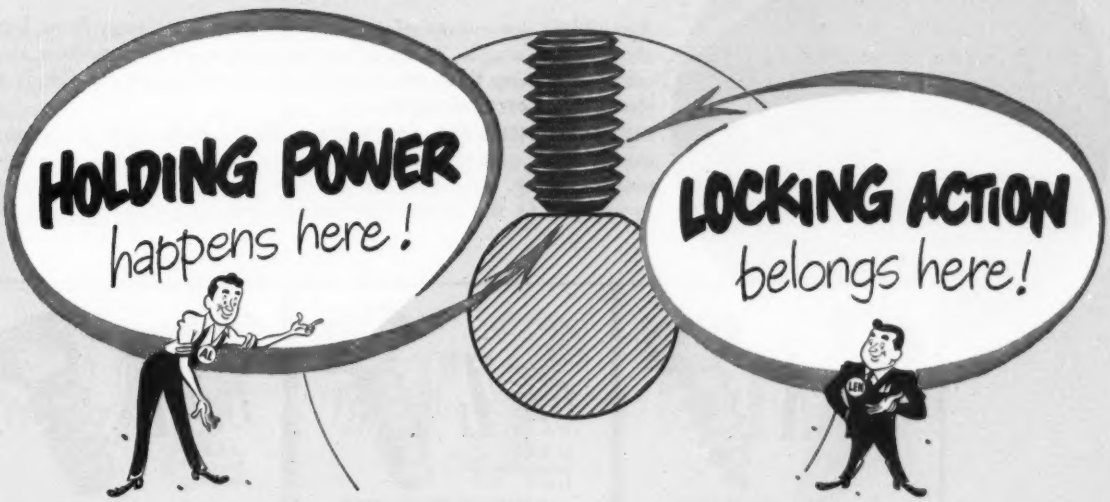
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 378)

WHEN YOU SPECIFY SET SCREWS, REMEMBER . .



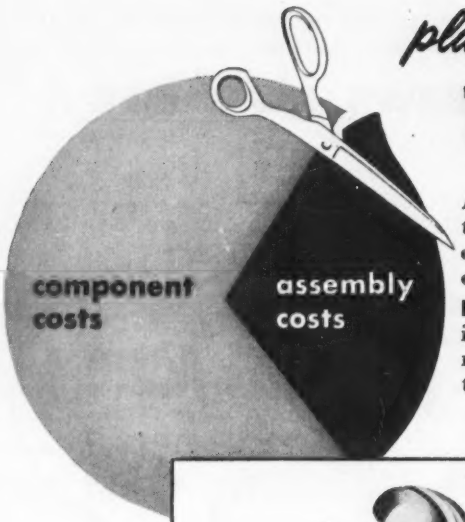
To do its job a set screw must *hold firmly* against both rotation and sideway motion, and it depends entirely on the *point* for this holding action.

Allen ○ screws hold better because they have the strength to permit firmer tightening, and because the points are designed *only* to produce maximum holding power.

Allen design does not compromise the holding power of the point in an attempt to make it perform a locking function too. Allen ○ screws require no locking action at the point, because of their high uniform accuracy of fit, pitch diameter and perfect thread lead. This provides maximum thread contact with ample friction to lock the screw in position during use and *re-use* under extreme vibrating stress.

THE **BUY** WORD IN SOCKET SCREWS IS **ALLEN**

WARNING
Allen-Type screws aren't necessarily Allen-Made.
Get genuine "Pressur-Formed" Allen ○ Head screws in this black and silver box.



plan fastenings to

Trim assembly's "bite"

Assembly's percentage of total production costs runs from less than 10% in simple "gadgets" to as much as 75% in modern aircraft. Trimming this percentage to the lowest figure possible is a challenge to every designer.

ELIMINATE NEEDLESS ASSEMBLY EXPENSE With the P-K Fastening Method, you eliminate tapping for machine screws, nut-running, riveting, or inserts in plastics. Since P-K makes many types, you fit the fastener to the job, *not* the job to a fastener.

	Type A	Type Z†	HEX HEAD Type Z†
	SLOTTED OR PHILLIPS HEAD	†A.S.A. Designation Type B SLOTTED OR PHILLIPS HEAD	†A.S.A. Designation Type B
uses	For fastenings to light gage (.015" to .050") sheet metals, asbestos compositions, resin impregnated plywood, wood, etc. The original Sheet Metal Screw. Forms its own matching thread as it is turned in. Can be removed and replaced.	For fastenings to light and heavy gage (.015" to .200") sheet metals, non-ferrous castings, plastics, resin impregnated plywood, asbestos compositions, etc. Forms its own matching thread as it is turned in. Can be removed and replaced.	For fastenings to light and heavy gage sheet metals (.015" to .200") and structural steel (.200" to ½"), non-ferrous castings, plastics, resin impregnated plywood, asbestos compositions, etc. Forms thread as it is turned in with socket wrench. Can be removed and replaced.
metals	Standard screws are hardened steel. Type 302 (18-8) Stainless Steel, non-hardenable (standard in some sizes). Type 410 Corrosion-resistant Steel, hardened (special order). Brass (special order).	Standard screws are hardened steel. Type 302 (18-8) Stainless Steel, non-hardenable (standard in some sizes). Type 410 Corrosion-resistant Steel, hardened (special order).	Standard screws are hardened steel. Type 302 (18-8), non-hardenable Stainless Steel, and Type 410, hardened, Corrosion-resistant Steel (special order).
special forms	Can be furnished on special order, quantity permitting. Some variations of the standard Type A form are shown.	Can be furnished on special order, quantity permitting. Some variations of the standard Type Z form are shown.	Can be furnished on special order, quantity permitting. Some variations of the standard Hex Head Type Z form are shown.
*** staps**	**Type A STAPS** The washer illustrated is a laminated metal and neoprene rubber disc, recommended for most applications of Type A Staps. Other types of washers can be used.	**Type Z STAPS** Since head styles are same as those of Type A, STAPS with Type Z thread form can be furnished. Metal backed neoprene washer is recommended.	**Hex Head Type Z STAPS** Shown with laminated metal and neoprene rubber disc, recommended for most applications. Other types of washers can be used.

*** STAPS** are P-K Fasteners with pre-assembled neoprene washers. They have many applications for effective control of leaks, squeaks, electrolysis and crazing in enameled surfaces. Furnished to special order, quantity permitting.

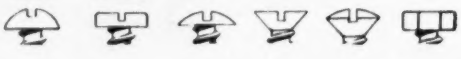
FINISHES

Standard plated finishes are Zinc, Brass, Nickel, Cadmium, or Parkerized. Other finishes on special order.

HEAD STYLES

Types A, Z, F, and F-Z Self-tapping Screws are available with any of these commonly used head styles:

ROUND BINDING STOVE FLAT OVAL HEX



in production costs

MAKE SURE PLANNED SAVINGS PAY OFF Specify *P-K Self-tapping Screws*. The *originator* of these time-proved fasteners, Parker-Kalon learned long ago how to provide the proper combination of hardness and toughness, the sharp threads and accurate size, the consistent dependability that keeps assembly trouble-free.

Question *every* fastening. A P-K Assembly Engineer will help you start making savings you've been missing. Parker-Kalon Corporation, 202 Varick St., New York 14.

SAVE up to 50% with the time-proved P-K METHOD

Type F-Z	*Type* F	*Type* U
SLOTTED OR PHILLIPS HEAD	SLOTTED OR PHILLIPS HEAD	
For fastenings to comparatively thin sections and bosses in friable and brittle plastics. Five cutting flutes distribute pressure evenly, permit chips to drop to bottom of hole. Coarse threads offer greater resistance to stripping out.	For fastenings to ferrous and non-ferrous castings, bronze or brass forgings, heavy gage sheet metals, structural steel, plastics, resin impregnated plywood, etc. Cuts standard machine screw thread as it is driven. Can be removed and replaced.	For permanent fastenings to ferrous and non-ferrous castings, heavy gage sheet metals, plastics, etc. Cannot readily be removed.
Type F-Z Screws are made on special order only, quantity permitting. Can be furnished in plain steel or stainless steel.	Standard screws are hardened steel. Type 410 Corrosion-resistant Steel, hardened, (special order).	Standard screws are hardened steel. Type 410 Corrosion-resistant Steel, hardened, (special order).
Can be furnished on special order, quantity permitting. Some variations of the standard Type F-Z are shown.	Modifications can be furnished as needed on special order, quantity permitting. Some variations of the standard Type F form are shown.	Some variations of the standard Type U form are shown. Modifications can be furnished as needed on special order, quantity permitting.
Type F-Z STAPS Since head styles are same as those of Type A, STAPS with Type F-Z thread form can be furnished. Metal backed neoprene washer is recommended.	**Type F STAPS** Since head styles are same as those of Type A, STAPS with Type F thread form can be furnished. Metal backed neoprene washer is recommended.	**Type U STAPS** Shown with molded neoprene washer, recommended for most applications of Type U STAPS. Other types of washers can be used.

PARKER-KALON® *The Original* **self-tapping screws**

for every metal and plastic assembly

TYPE 21

For fastening fibre, leather, fabric, cardboard, etc., to sheet metal. For permanent fastenings.

OTHER P-K FASTENERS

Cold-forged SOCKET SCREWS, WING NUTS and THUMB SCREWS. Hardened SCREWNAILS and MASONRY NAILS.

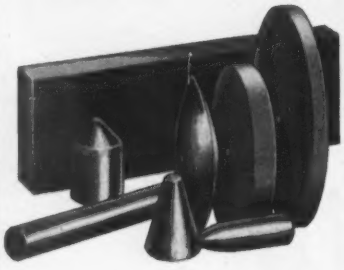
IF IT'S P-K IT'S O.K.

Reduce Labor Costs — Speed Production with

CRATEX

The World's Finest RUBBERIZED ABRASIVES

"cushioned action performance"



There are over 160 standard sizes and shapes of Cratex Rubberized Abrasives available to meet your needs in

BURRING, SMOOTHING and POLISHING operations

Manufactured in four "grit types" from coarse to extra fine, Cratex saves production and labor costs by doing one or more operations at one time—such as Cleaning, Blending, Lapping, Finishing, and Trimming—on hard or soft

METALS, PLASTICS, GLASS and scores of other materials.

CRATEX Rubberized Abrasives

Wheels, Points, Blocks, Sticks, Cones

—are ideal for manual or machine application—require no special equipment—always ready for instant use. For over 30 years, Cratex has served industry with unparalleled results—an unduplicated reputation for lowering "unit costs" in burring, smoothing and polishing operations. Investigate Cratex Rubberized Abrasives . . . "The World's Finest For Industrial Use" . . . send today for Descriptive Catalog which gives full details, applications and prices.

FREE CRATEX TECHNICAL SERVICE

Get the assistance of our abrasive engineers on your burring, smoothing and polishing problems. Merely check the coupon for "Application Analysis Form." This Cratex service will be helpful.

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81 Natoma St., San Francisco 5, Calif.

Without any obligation please send us—

☐ Descriptive Catalog.
☐ Application Analysis Form.

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CITY _____ ZONE _____ STATE _____

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besly-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, Geo., Mich. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Diversified Metal Products Co., 5125 Alcoa Ave., Los Angeles 58, Calif.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Inc., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Chucking

Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

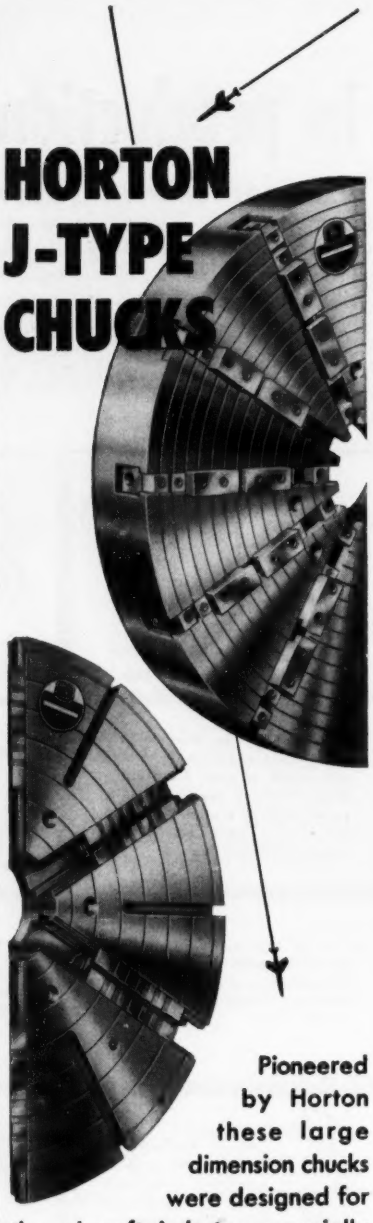
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Dumore Co., 1300 17th St., Racine, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

(*Continued on page* 380)

HORTON J-TYPE CHUCKS



Pioneered by Horton these large dimension chucks were designed for the aircraft industry especially for machining various jet engine parts.

For 102 years Horton Chucks have kept pace with industry's demands.

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Since 1851
DIVISION OF
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AJAX *High Speed* Forging Presses

MORE ACCURATE FORGINGS at HIGH PRODUCTION SPEEDS

AJAX PRESSES are built in a wide range of sizes

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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
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Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Drill

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

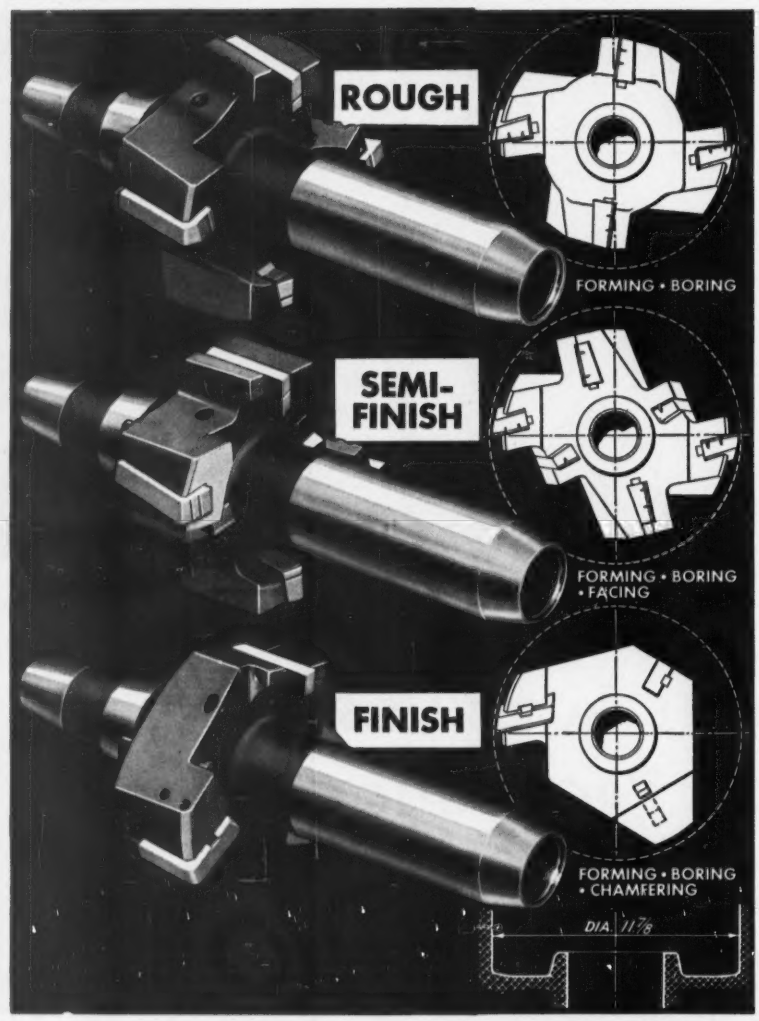
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Besly-Welles Corp., Beloit, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment.

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.



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These large diameter special cutters see the job through from start to finish. Thousands of such multi-operation tools have been made by GAIRING in all sizes to solve various production problems • They range from large tools, shown here, to small cutters that may be held in standard counterbore holders. Send us your parts prints for a quotation on your requirements. Or ask our nearest representative to discuss any special or standard tools you may need.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Schutte, Alfred H., Koln-Deutz, Germany
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Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

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Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
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Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
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Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
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Pratt & Whitney, West Hartford 1, Conn.

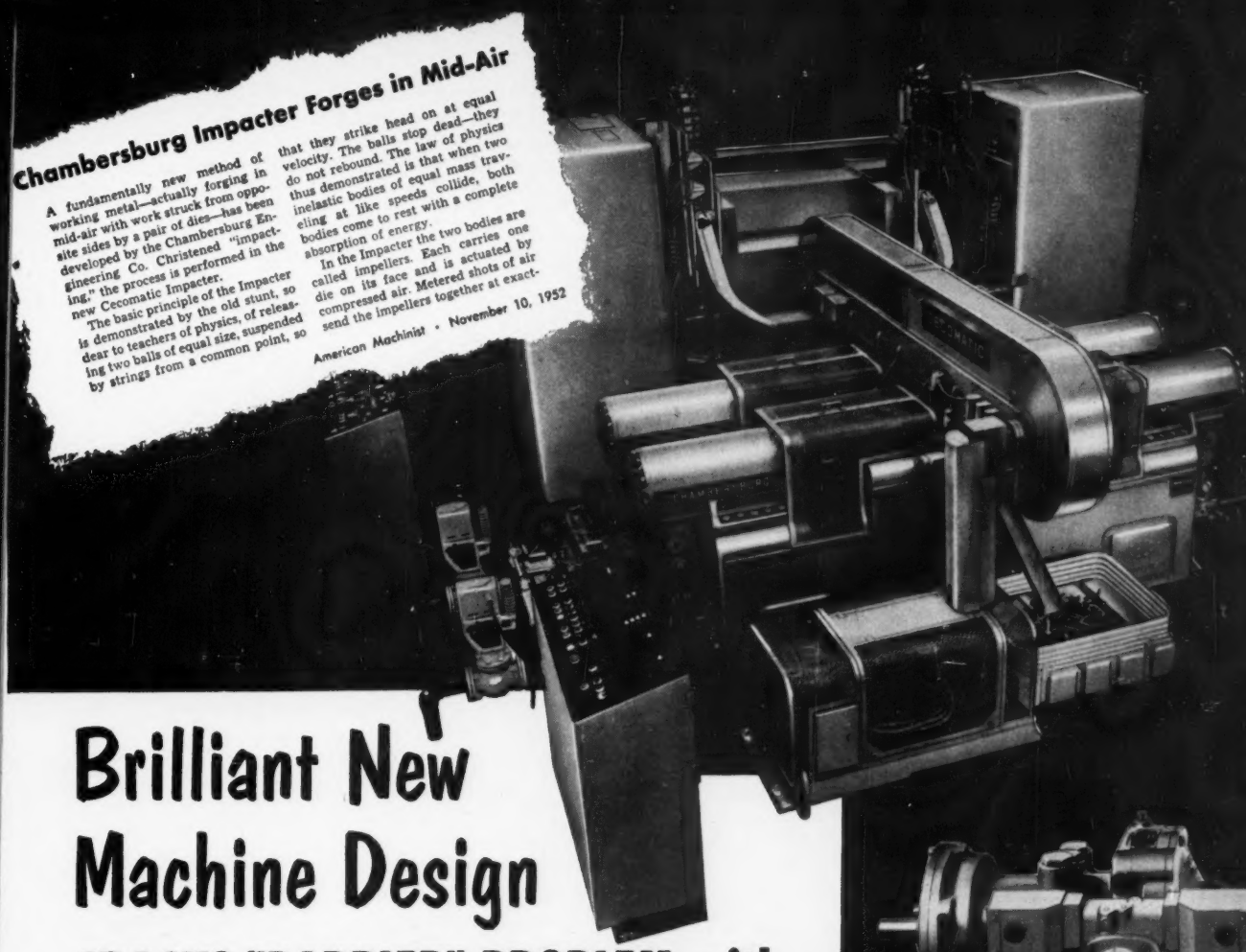
GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

(*Continued on page* 384)


Chambersburg Impacter Forges in Mid-Air
A fundamentally new method of working metal—actually forging in mid-air with work struck from opposite sides by a pair of dies—has been developed by the Chambersburg Engineering Co. Christened "impacting," the process is performed in the new Cecomatic Impacter.
The basic principle of the Impacter is demonstrated by the old stunt, so dear to teachers of physics, of releasing two balls of equal size, suspended by strings from a common point, so that they strike head on at equal velocity. The balls stop dead—they do not rebound. The law of physics thus demonstrated is that when two inelastic bodies of equal mass traveling at like speeds collide, both bodies come to rest with a complete absorption of energy.
In the Impacter the two bodies are called impellers. Each carries one die on its face and is actuated by compressed air. Metered shots of air send the impellers together at exact-
American Machinist • November 10, 1952

Brilliant New Machine Design

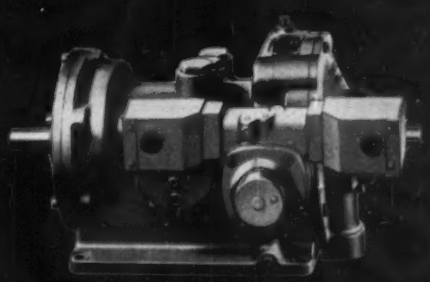
CRACKS "BARRIER" PROBLEM with OILGEAR FLUID POWER

Once the "forge-it-in-mid-air" idea occurred to the Chambersburg Engineering people, there were two "barrier" problems to be smashed before the idea became a brilliant reality. Something of the seriousness of the problems is indicated by the fact they spent 10 years to get the right, precise integration of movements and forces required.

One problem, that of getting the blanks to be forged into the right place at the right time for the mid-air forging blow, was eventually solved by recourse to *Any*-Speed Oilgear Fluid Power. The standard totally enclosed Oilgear Transmission with integral electro-hydraulic control gave the designers of the Cecomatic Impacter remote, interlocked, precise control of the conveyor . . . quick, cushioned acceleration . . . high traverse speed . . . fast, cushioned deceleration . . . smooth stop and dwell in forging position; all at the speed and accuracy they needed . . . just as so often in the past Oilgear has given *other* machine designers what *they* wanted.

Maybe your problem can be solved, your machine's performance improved by the smooth, swift acceleration and deceleration of the *Any*-Speed Oilgear. Maybe you need its extreme precision of controllability . . . or any of a dozen other remarkable characteristics. In addition you get simplicity, ease of assembly into your machine, ruggedness, dependability, accessibility, a unique freedom from maintenance.

But whatever your need, *you have not exhausted all possibilities in machine design if you have not investigated Oilgear Fluid Power Pumps, Motors and Transmissions exhaustively.* You too may have a world beater in your hands. THE OILGEAR COMPANY, 1569 W. Pierce St., Milwaukee 4, Wis.

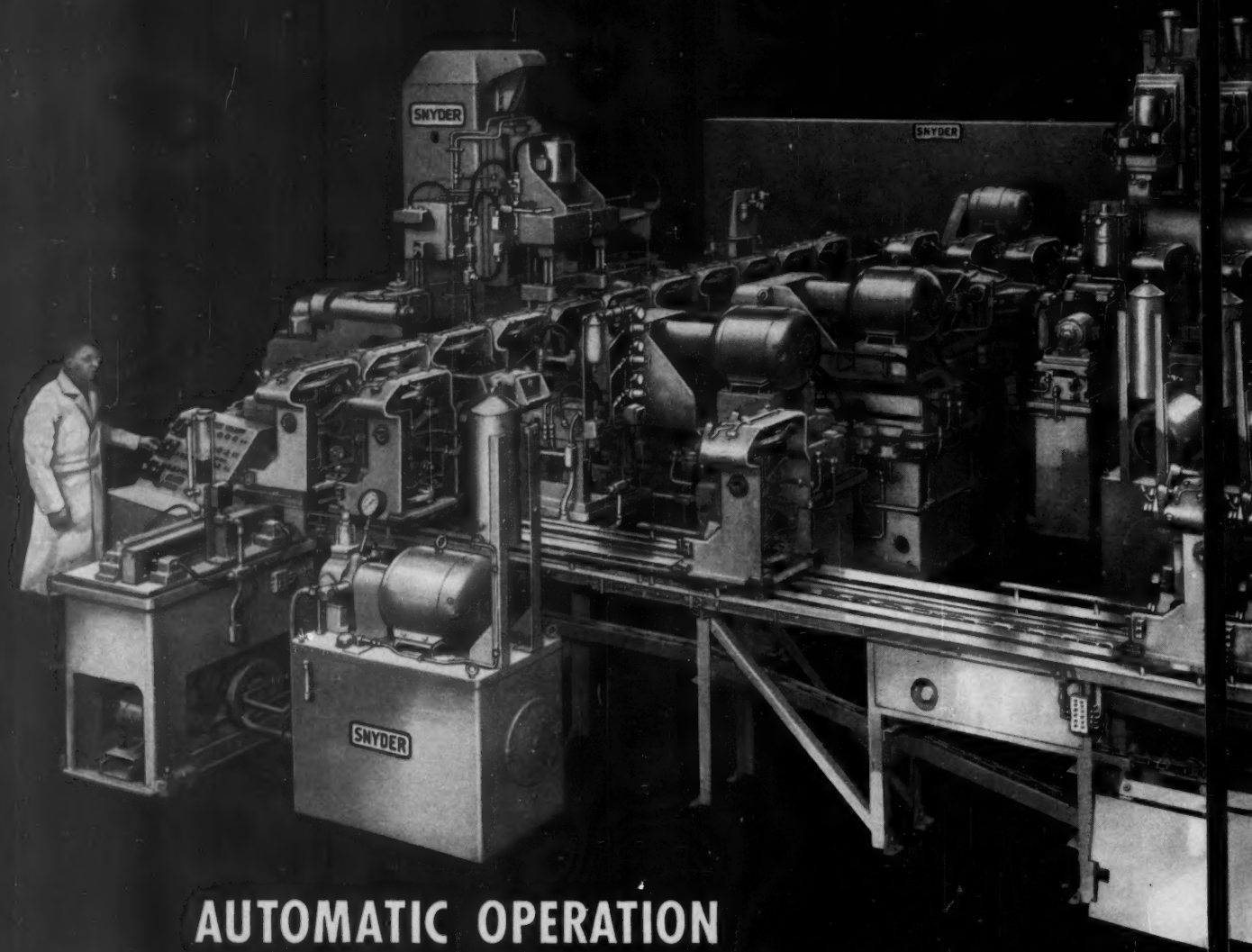


Cecomatic Impacter doubles, triples, quadruples—octuples forging production! No jar or vibration. Less metal stress and die wear. Blanks load into conveyor automatically. And automatically the Oilgear type AXB-33 Variable Speed Transmission accelerates conveyor swiftly, smoothly, it smoothly stops with forging blank "dead on target," waits for the forging blow, then accelerates forged part away and new blank into position. Oilgear is adjustable up to 40 cycles per minute, is easily set to any required index distance which is then maintained under complete automatic control with unvarying precision.

OILGEAR

OILGEAR

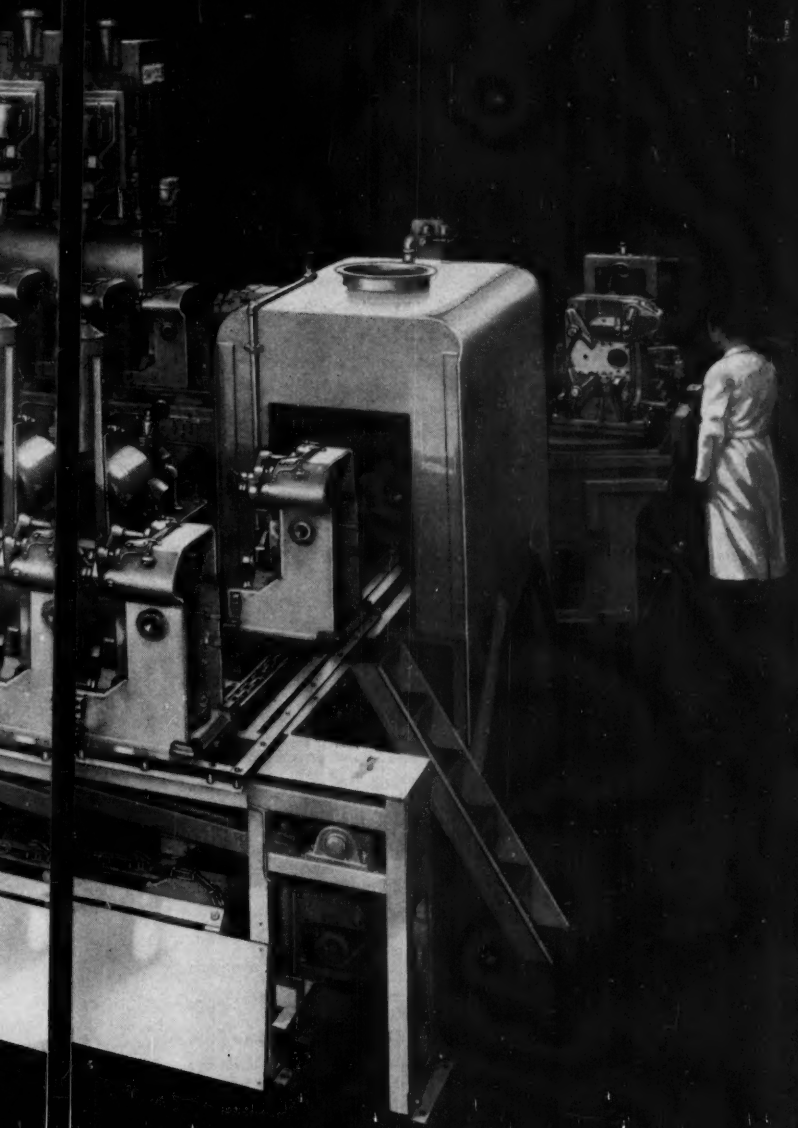
SNYDER MACHINES CONTROL COSTS

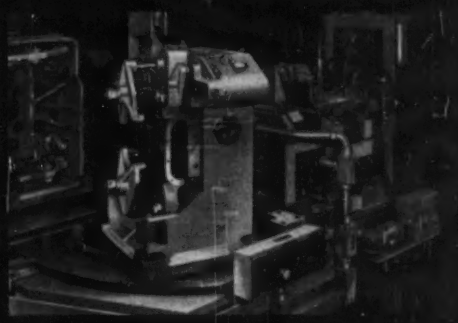


AUTOMATIC OPERATION

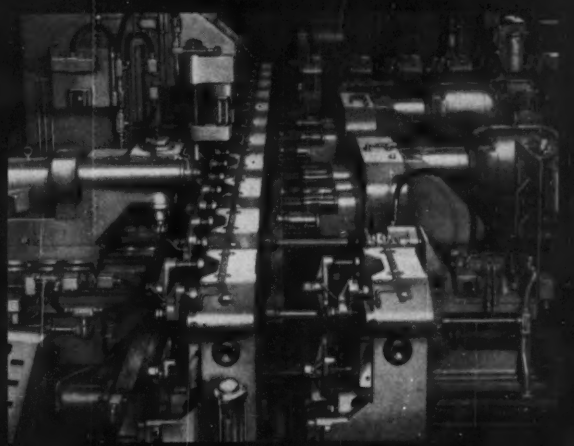
MILLS, DRILLS, TAPS, BORES, COUNTERBORES, COUNTERSINKS FRONT COVERS FOR AUTOMOTIVE ENGINES • AUTOMATIC INDEXING, LOCATING, CLAMPING, AND RELEASING • AUTOMATIC TRANSFER THROUGH TWO-STAGE, CONTINUOUS WORK CYCLE • AUTOMATIC CONTROLS • AUTOMATIC SAFETY INTERLOCKING SYSTEM • AUTOMATIC LUBRICATION • AUTOMATIC CLEANING AND CHIP REMOVAL • SKILLED OPERATORS NOT NEEDED

18 STATION AUTOMATIC TRANSFER
180 FRONT COVERS AN HOUR AT 100% EFFICIENCY





At Station 18 the fixture is rotated 90°, air wrenches unclamp the part so that it is easily removed. The fixture returns to Station 18, engages the return conveyor, is automatically blown clean and returned to the loading station.



Fixtures leaving Section 1 (above) move at right angle so that the other faces and top of the part are exposed to tools. The part enters the work cycle with three ground faces, leaves it ready for assembly.

SNYDER

TOOL & ENGINEERING COMPANY

3400
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Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Radial, Ball Race, Etc.
Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radius, Link
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

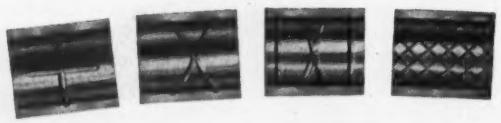
GRINDING MACHINES, Ring Wheel
Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.

High Speed
CONTINUOUS OIL GROOVING
500 PIECES PER HOUR!



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The operator loads and unloads the work **without stopping the Machine** — a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8"; grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4½" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO

SINCE 1868

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread
Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Landis Tool Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS
Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Bay State Abrasive Products Co, Westboro, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati, Ohio.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

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Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air
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(*Continued on page* 386)

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FTR 3153-AS	220/440	3	50/60	115/230	6.6/3.3
FTR 3154-AS	220/440	3	50/60	115/230	8.8/4.4
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Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

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Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

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HAMMERS, Shaft
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Chambersburg, Engrg. Co., Chambersburg, Pa.

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Chambersburg Engrg. Co., Chambersburg, Pa.
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SPECIFICATIONS

Horsepower	5 to 10	Diameter of spindle	3"
Spindle speeds by pick-off gears	33 to 500 rpm	Morse taper of spindle	No. 5
		Length of stroke	10"

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See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

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National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
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Union Twist Drill Co., Athol, Mass.

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Bethlehem Steel Co., Bethlehem, Pa.

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Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

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HOISTS, Electric
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONES
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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

HYDRAULIC MACHINERY, Tools and Equipment
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(*Continued on page 390*)

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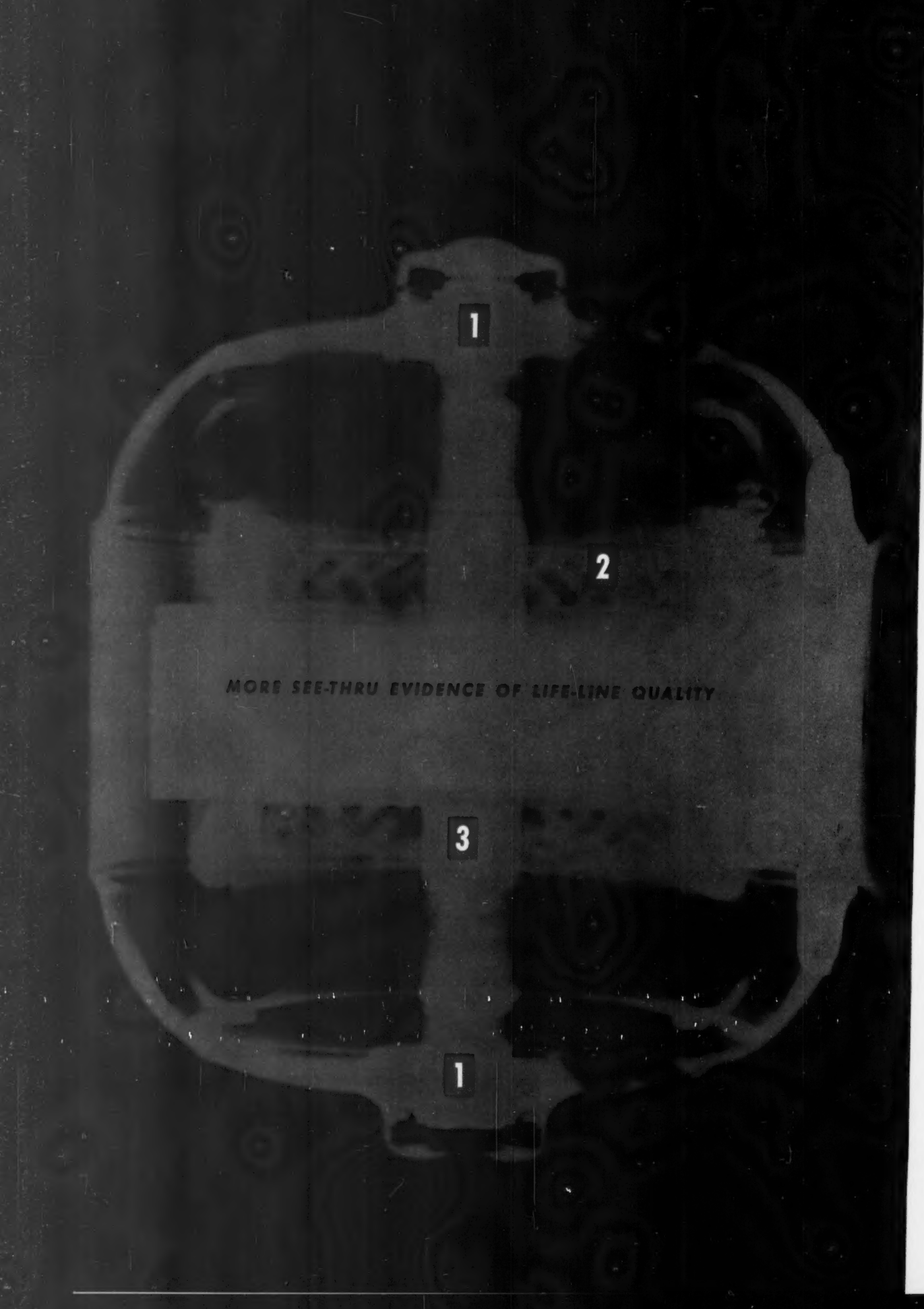
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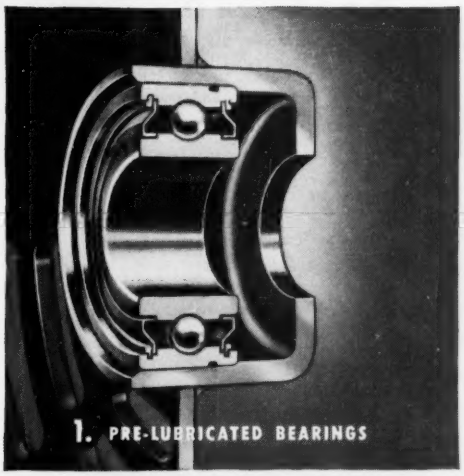

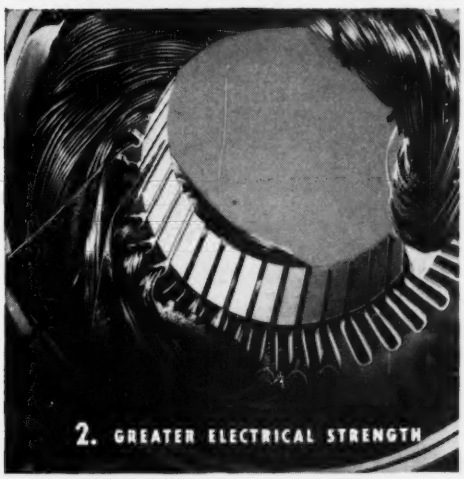

X-Ray camera bares construction of *Life-Line* motors

Here's more see-through evidence of why your best motor buy is Life-Line*. Pictured at the left is an actual X ray of a Life-Line 1-hp, 3-phase, squirrel-cage induction motor. The three inset illustrations show additional details of the most important Life-Line features.

Glance at the top inset and you can tell that this is the Life-Line *pre-lubricated* bearing . . . packed with grease and *sealed* at the factory. It needs no further lubrication and is protected for life against dirt and moisture. Also, you can observe how the seals keep grease from escaping regardless of mounting position.

Now, move your eye down just a little. You're getting an inside view of the Life-Line winding design that increases motor life. See why? Round-bottom stator slots leave no voids to collect dirt and dust—no dead air spaces to restrict conduction of heat. Tufvar® enameled wire coils improve insulation. Coil groups are wound in series to reduce the number of joints.

You can't see from looking at this rotor that it has been dynamically balanced to give you maximum freedom from vibration and noise. However, you can see that rotor bars and end rings are pressure cast from aluminum alloy. Also, note the skewed rotor slots that give smoother, quieter operation.

Of course, you haven't really seen anything yet. You haven't seen the figures that show how much Life-Lines can cut your costs, or how much they increase production. Call your Westinghouse representative or write to Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Penna.. and ask for *Motor Cost Analysis*, booklet B-6052.

*Trade Mark

J-21778

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Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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(*Continued on page* 392)

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
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LATHES, Axle

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
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(*Continued on page 394*)

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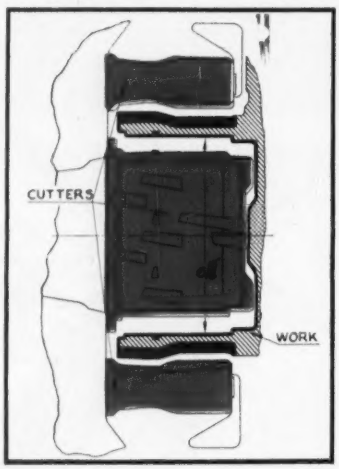

Simultaneous form milling of internal and external surfaces of heat-treated alloy steel propeller hubs

By doing this job on the Hall Planetary many separate operations were eliminated, saving time and cost, and assuring greater concentricity. The surfaces milled are shown in black and illustrate how well the Hall Planetary is adapted to large metal removing operations.

Rotating eccentric containers in the Hall Planetary produce the exclusive planetary movement. The spindle on which the cutters are mounted rotates within these eccentrics and moves in a circular arc from the center, beginning to cut near the extreme of the eccentric. The cutters then move around the circumference of the work, completing the cuts and automatically returning to center in one revolution.

This job also demonstrates another Hall Planetary advantage: The work is held stationary, a feature which simplifies the handling of parts (like this propeller hub) which, because of their size or shape, are not easily rotated. And, because the work fixture is secured to the head, accuracy and rigidity are assured.

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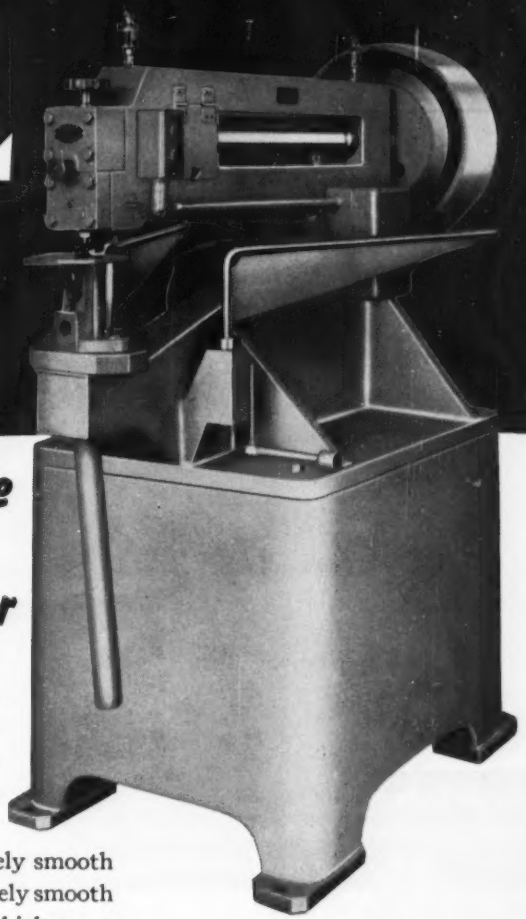
ACCO products

CAMPBELL Nibbling Machines

Model 2524
CAMPBELL
Nibbling Machine



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• With the CAMPBELL Nibbling Machine a template clamped above the work guides the punch accurately to cut any shape or design. The cut can be made in any direction without head adjustment, thus permitting the operator to feed the work with both hands.

CAMPBELL Nibbling Machines leave a relatively smooth edge, which requires finishing only when an absolutely smooth edge is required. They can be furnished to cut all thicknesses of metal up to ½". Cutting speeds on various models can be quickly changed to suit the types of material to be cut and the various thicknesses. Drive is completely enclosed for safety.

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H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
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H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Corp., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.

(*Continued on page* 396)

for Precision
+ Low Cost:

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GEAR HOBBER #79

Mikron Hobbing Machines Excel Where High Precision Machining Standards Must Be Maintained

• **MIKRON No. 79** is an excellent choice for small spur gears and pinions. It is simple to operate, to set-up and to change-over from job to job. CAPACITY: Gears, max. dia. $1\frac{9}{16}$"; max. length of cut $1\frac{1}{8}$"; number of teeth 6 to 390; pitch DP 26 and finer.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lehmann, J. M., Co., Inc. 55 New York Ave., Lynhurst, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS

Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

MASKS, PAINTING

Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision

Alina Corp., 401 Broadway, New York 13, N. Y.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS

See Recording Instruments.

MICROMETERS

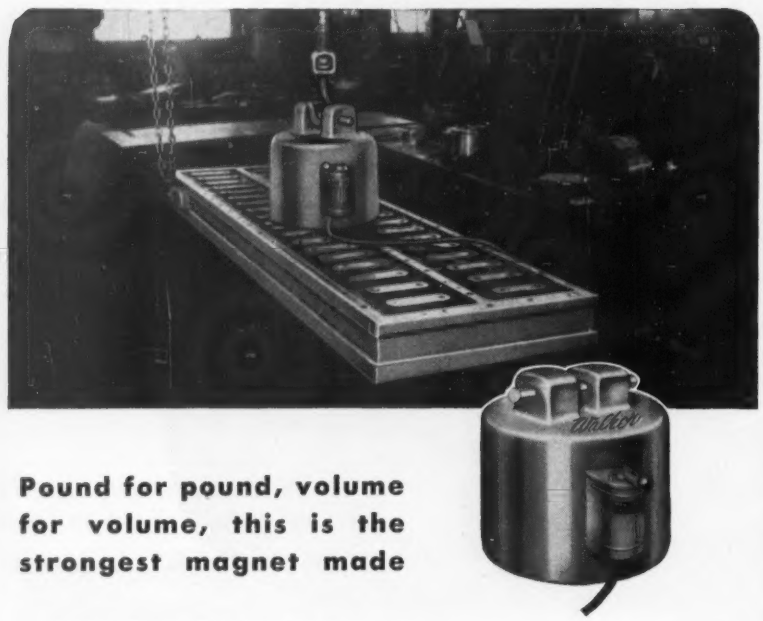
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 398)

Walker Does It Again-



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The Walker material is high in permeability and magnetized to complete saturation with equal flux distribution. . . . The Walker line includes contoured lifting magnets increasing the area of contact for special applications (for wire, pipe, etc.).

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IN CANADA — UPTON BRADEEN & JAMES LTD.

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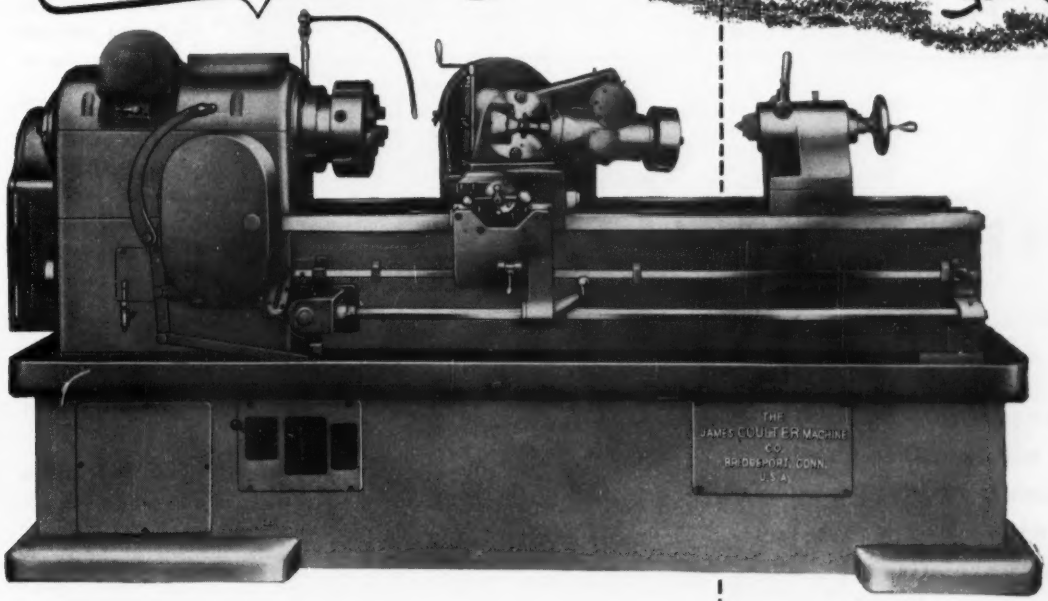
The only answer to high cost production blues!



Get set to sing a happy tune, for **COULTER** can help you banish those *"labor shortage/reject/poor production of threaded part/blues"*.

The **COULTER** "Threadmaster" (shown above) is one thread milling machine that can produce long and short precision traversing, elevating, crossfeed and lead screws in less time with uncanny accuracy.

Investigate **COULTER AUTOMATIC THREADING MACHINES** today — change the "blues" to "cheers" — extract *every cent of profit* possible out of your plant and still maintain the high quality standards you demand.

IF YOU ARE CONFRONTED with a thread production problem, our engineers can help you. Literature available.

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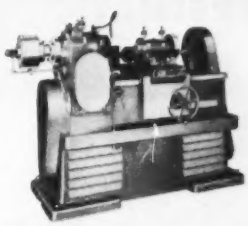

Model "H1" COULTER HOB THREADING MACHINE produces internal, external, right and left hand threads with precision — Faster — Accurately — AUTOMATICALLY.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

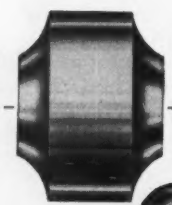
MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

Making parts like these?

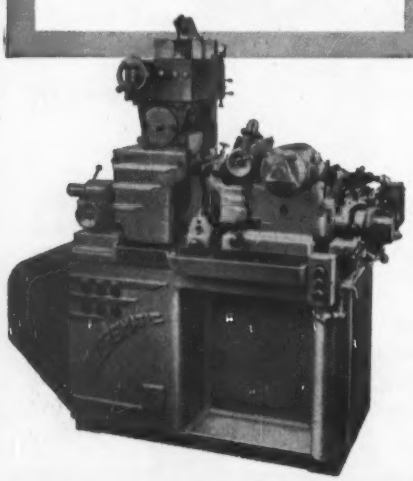


Both radii concentric with bore

Both ball ends concentric with shaft axis

You can Centerless Grind all Surfaces Simultaneously, Insure perfect Concentricity on a DIVERSIMATIC

Having concentricity problems on precision formed parts? Need better finish? DIVERSIMATIC with the new CRUSH FORMING attachment gives you the answer.



CRUSH FORMING profiles the wheel to exact contours; imparts these shapes to rough-turned parts, grinding all surfaces simultaneously. Where formed parts require only a nominal amount of metal removed, *they can frequently be ground from the solid!*

CRUSH FORMING on centerless grinding is exclusive with DIVERSIMATIC. It's possible only because of Diversimatic's unusual, deflection-free, anti-friction spindle . . . *The spindle that needs no warm-up!*

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Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Mchry. Corp., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(*Continued on page* 403)

You can obtain custom-cut felt parts from American, ready for assembly without further processing. Gaskets, washers, seals, wicks, discs—any shape you need, simple or complicated, can be turned out by us on high-speed machines, with tolerances to meet your specifications.

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These are manned and managed by men who will see that your production is never slowed up by lack of cut felt parts.

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Lifting Aviation's Glass Fiber

The increasing speeds attained by jet aircraft, guided missiles, and rockets develop high surface temperatures that are a growing problem to the aviation engineer. Some conventional structural materials lose much of their mechanical strength with continued exposure to such heat.

Among the newer materials developed to lift the "heat barrier" are glass fiber-phenolic plastic laminates bonded with BAKELITE Phenolic Resin BV-11946. They have a high strength-weight ratio. They retain a high percentage of initial strength properties up to 500 deg. F. for periods up to and exceeding 30 minutes. They have low heat-transfer properties, and their coefficient of expansion is lower than that of comparable metal structures. They resist corrosion by sea water, fuels, hydraulic fluids, lubricating oils, and air at high temperatures.

Parts made of these phenolic resin laminates are produced with a minimum of tools, jigs, and fixtures, saving costly floor space. Designing such reinforced plastic structures can also result in man-hour savings in both tooling and production operations.

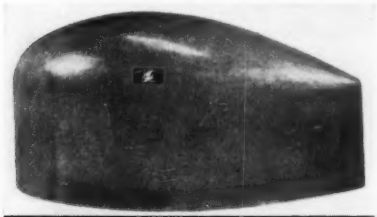
Moldable at pressures as low as 10-50 psi, glass fiber-phenolic resin laminates can be cured in minutes when matched metal molds are used. Rubber bag or diaphragm molding are also practicable. They can be handled in dry form and laid up in a mold in much less time than the conventional wet lay-up system requires.

For more information on the use of glass fiber laminates made with BAKELITE Phenolic Resin BV-11946, write Dept. RC-19, presenting your requirements. Bakelite Company engineers are available to assist in evaluating and working out your plans.

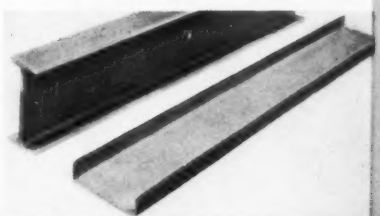
"Heat Barrier"... Phenolic Plastic Laminates

Exhaust duct made by using break-away plaster mold

Air intake for aircraft, made with a matched metal mold



Fairing made on male mold, rubber bag method, vacuum pressure



Channel and I-beam molded by rubber bag method

Hot air duct, formed by wrapping impregnated glass cloth over split mandrel, covering with cellophane, and curing for one hour at 300 deg. F.

Photographs courtesy of Zenith Plastics Company, Gardena, Cal. and Bassons Industries, Bronx, New York.

BAKELITE
TRADE-MARK
PHENOLIC RESINS
TRADE MARK

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A Division of
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with completely centralized controls . . . instant selection of proper speed, feed; easily set automatic stops and trips.

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tested safety devices safeguard machine, worker, workpiece . . . automatic lubrication protects built-in precision.

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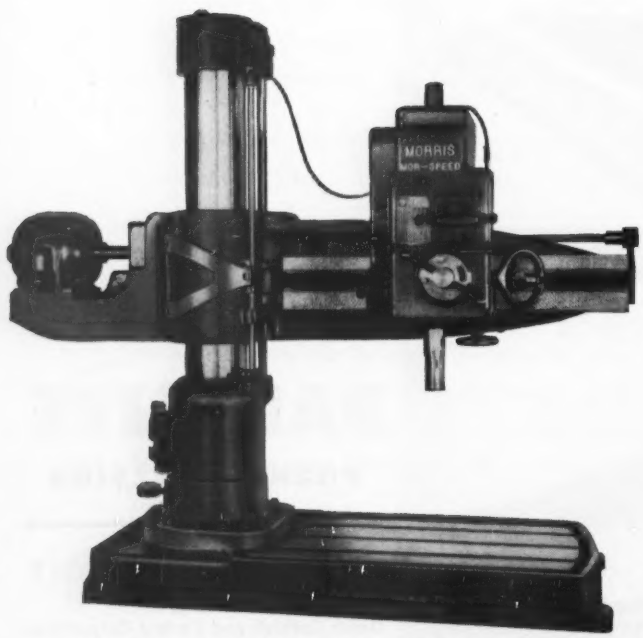
alloy steels . . . modern hardening . . . extra anti-friction bearings, all assure minimum wear and low cost service.



9" Column Standard and Heavy Duty Models (with 3 and 4-foot arms)

11" Column Heavy Duty Model (with 3, 4, 5 and 6-foot arms)

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Whether for production or tooling MORRIS Mor-Speed RADIAL DRILLS give you fast, easy operation with accuracy so essential in holding down costs. Write for bulletin #59. Early deliveries available.

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Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Planetary Type
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

MILLING MACHINES, Profile
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Mchry. Co., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford. Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES
Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUMBERING MACHINES
Numberall Stamp & Tool Co., Staten Island, N. Y.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co. Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-Locking
Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
Grip Nut Co., 310 S. Michigan Ave., Chicago 4,
(*Continued on page 404*)

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Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

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Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

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C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

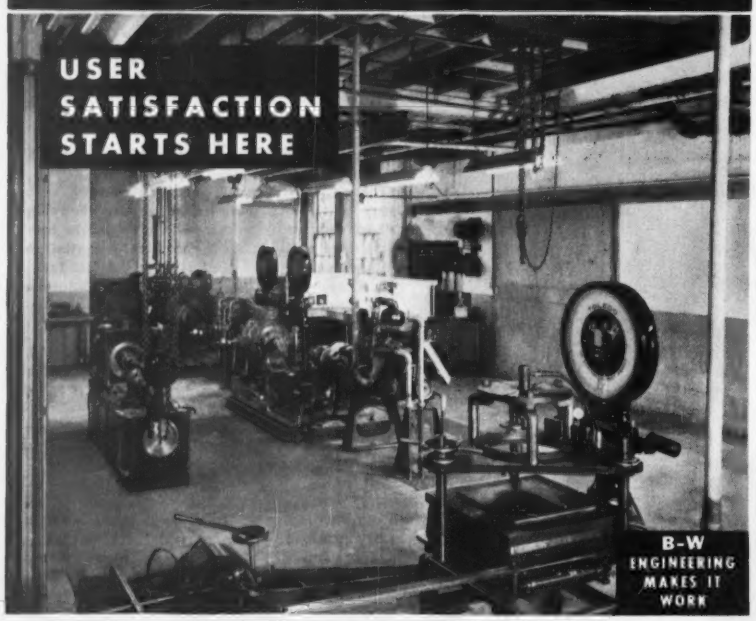
PIPE STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(*Continued on page 406*)

ROCKFORD CLUTCHES



Every type and size ROCKFORD CLUTCH must pass torque, strength, pressure, spin, heat, balance, wear, deflection, friction, run-out, flatness and endurance tests before being put into production. These torture tests are made on specially designed, accurate, clutch-checking machines. Let our engineers give *your* products the benefit of ROCKFORD test-proved CLUTCH reliability.

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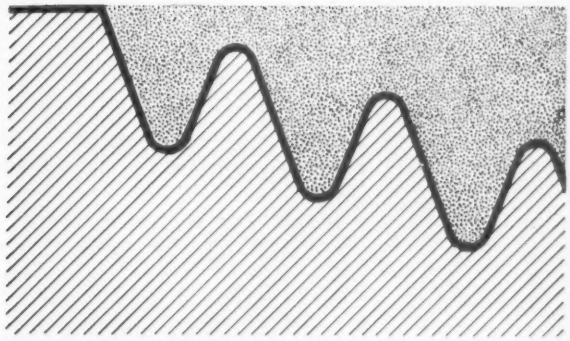
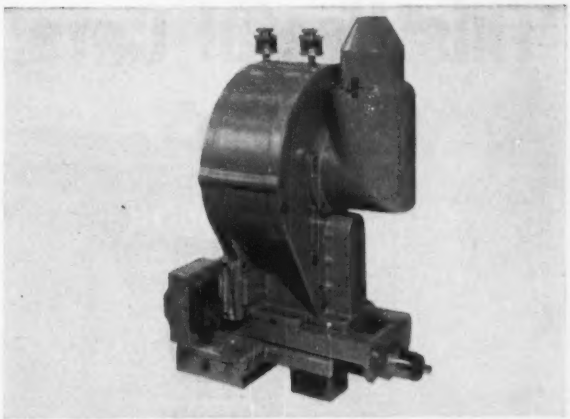
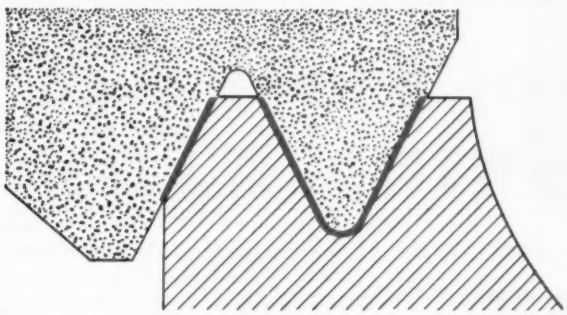


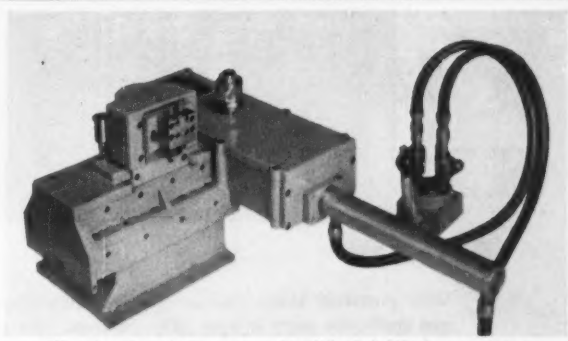
Pine-tree form at base of jet-engine bucket has a combination of convex and concave surfaces difficult to put into a grinding wheel—without the Hoglund Model-7B Dresser.



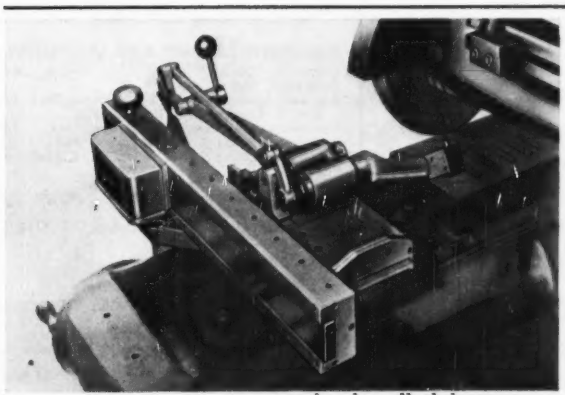
Automatic and electric-motor powered, the Model 7-B eliminates all skill in dressing. Two circular cams move the diamond across and into the wheel, providing a very compact unit. It is being used on the Thompson double-wheel bucket and blade grinder.



Compressor-blade root form has extremely close tolerances. A Model-32 Hoglund Dresser mounted on a Thompson Surface Grinder provided the high degree of accuracy and perfect blending of radius and tangent needed.



The hydraulic automatic Model-32 dresses in one continuous, smooth movement across the wheel. Diamond movement is reduced from the magnified contour template by inclined planes—there is **no** pantagraph linkage.



Three-inch-wide wheels can be handled by our newest model, the KB11-3 manual dresser. It will fit on any horizontal surface grinder—and will dress any contour, no matter how complex, that can be entered by the diamond.

We make over 40 models, both special and regular, for surface, cylindrical and gear grinding machines. They all share four common features: (1) Pantograph linkage eliminated, usually by inclined planes. (2) Wheel dressed in one continuous operation. (3) Compactness and light weight. (4) A microscope fixture for precise setting of the diamonds in their holders.

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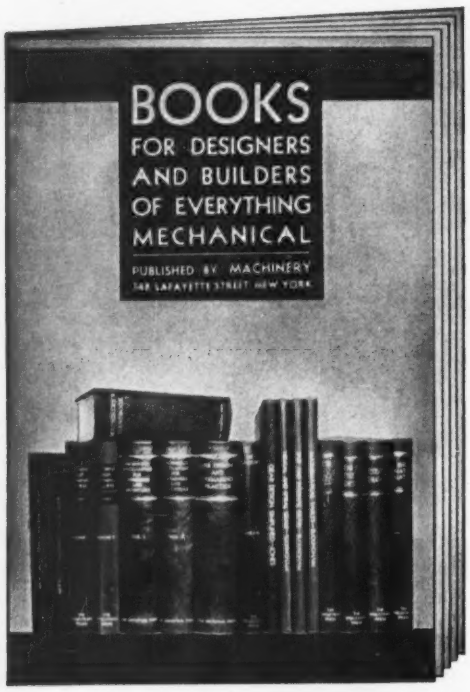

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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
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Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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PLATE ROLLS

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Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
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Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

PNEUMATIC EQUIPMENT

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Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Omrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co. (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

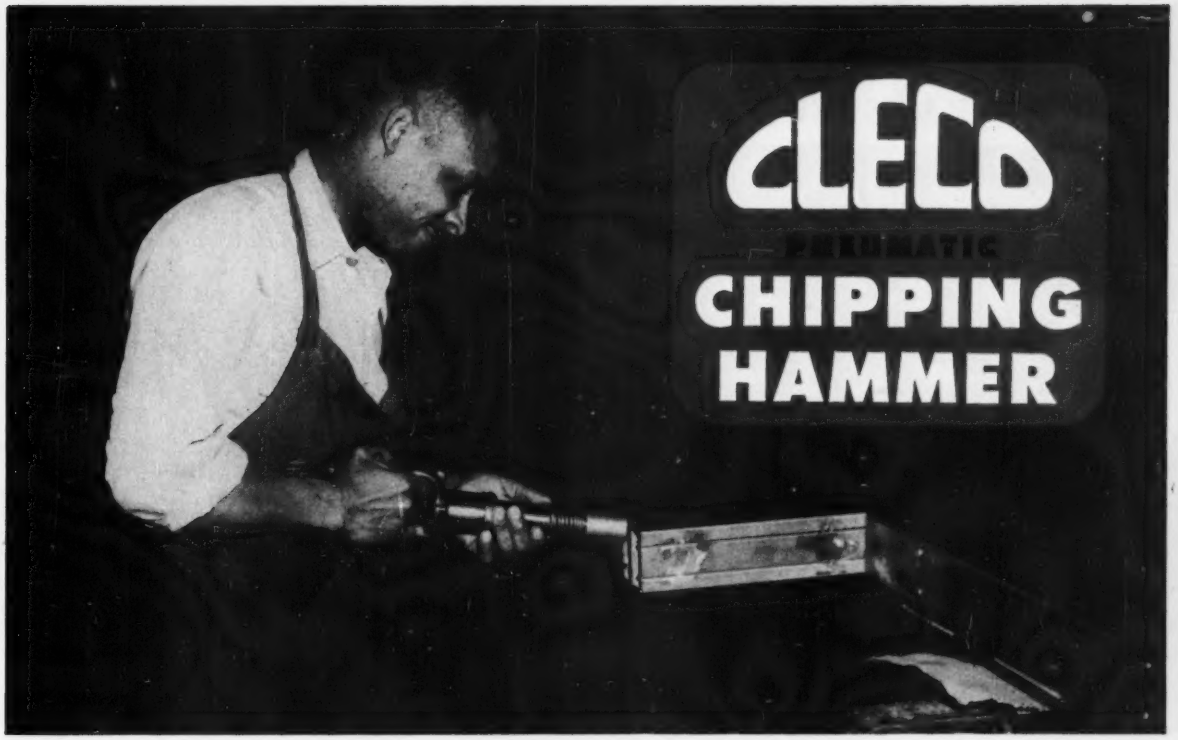
POLISHING TOOLS, Portable

Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Jarvis, Charles L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

(*Continued on page* 410)



This tough job solved with a CLECO CHIPPING HAMMER

The sheet metal post you see here connects two sections of a metal partition for hospitals.

This post drives on channels to a tight friction fit. The finished assembly is rugged, clean and simple—but there was a difficulty.

Various methods of driving the post in place were tried. All were slow and costly. Furthermore, posts frequently buckled as a result of the pounding.

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Look over your special production problems with a Cleco field engineer. He can help you devise ways to save money and speed production.

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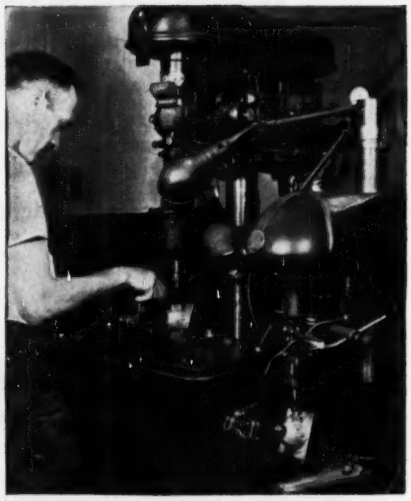

DELTA Means MOBILITY–

Says Astatic "An example of how we move our Delta tools to the job is the case of putting two 17 inch drill presses side by side so that a piece can be countersunk on one, tapped on the other by the same operator. In many cases we move Delta tools to the material instead of the material to the machine."

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"With simple fixtures and Delta accuracy we make jobs practically fool-proof on machines which almost run themselves," reports the Astatic Corp. Astatic products for the communication industry are manufactured to high precision standards.

Down Go Costs

WHEN ASTATIC CORP. PUTS DELTA TOOLS ON JOB

These Production Ideas Will Work For You, Too.

Here's how the Astatic Corp., Conneaut, O., gets high production and high precision at low cost with a shop full of Delta tools—drill presses, grinders, bandsaws, table saws, jointers and belt sanders. This story of a manufacturer of microphones, radio, phonograph and television parts can apply equally well to your plant.

FLEXIBILITY — Because Delta tools are light and mobile, Astatic takes them to the material to be machined, cutting handling costs. They are moved in and out of the production line as jobs change, already set up to eliminate down time. As many as five different materials from steel to plastics are machined on the same Delta tools.

INTERCHANGEABILITY — By standardizing on Delta, Astatic uses the same jigs and fixtures on several machines without adjusters.

FEWER SET-UPS — By keeping machines set up for special jobs one operator can tend several machines and do sequence operations on a single part before laying it down. No waste motion. Because Delta tools are a low capital investment, they don't have to run constantly to pay out.

QUALITY — Most of the Delta tools at Astatic have been on the job six to nine years with only routine maintenance. The Astatic record proves that Delta gives you machine tool quality at a cost any production operation in your plant will justify.

Do you have an up-to-date catalog of Delta tools? Call your Delta dealer. He's listed under "Tools" in your Classified Phone Book. Or write direct to Delta Power Tool Division, Rockwell Manufacturing Company, 614G N. Lexington Avenue, Pittsburgh 8, Pa. Ask for Catalog AB52.

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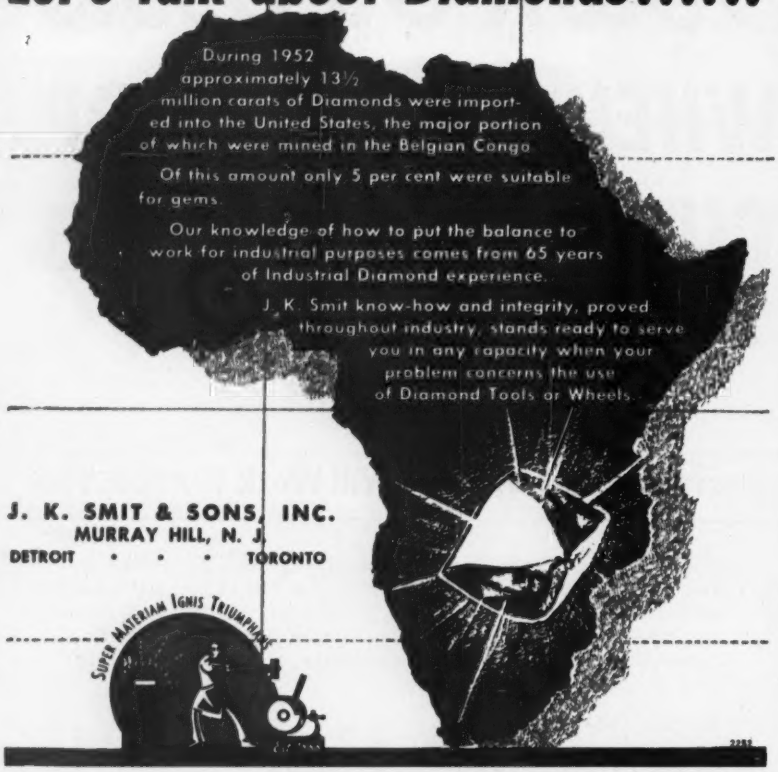
Here's the Astatic story: "Because the cost of Delta tools is low, it is advantageous to maintain set-ups even if they are used only intermittently. Often an operator performs an operation on one machine, then turns to another for the second operation, saving the cost of repeated set-ups."

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

Let's talk about Diamonds.....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Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
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Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

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Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

PRESSES, Forging

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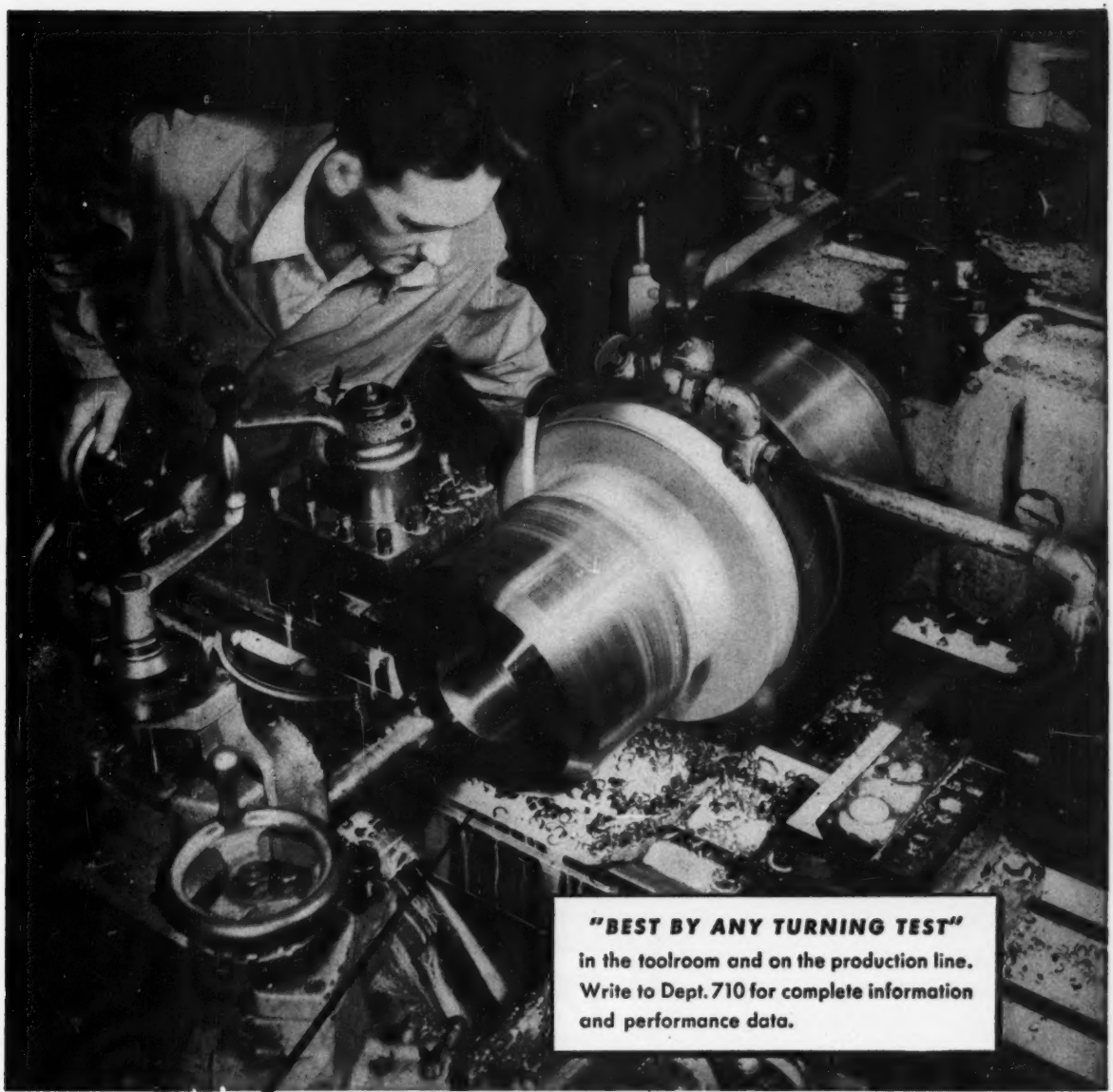
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

(*Continued on page* 414)



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ONLY LAMINATED SHIM OFFERS YOU ALL 5

ONLY LAMINATED SHIM OFFERS YOU ALL 5 SOLUTIONS

Here's a quick picture of the shimming methods which are at the disposal of designer and production engineer. In actual use, many factors affect choice of proper type, for shim engineering has become a science unto itself. Be sure you check with us for an impartial recommendation. Remember that only The Laminated Shim Company offers you all 5 types of shims.

THE LAMINUM® SHIM

SIMPLY PEELS FOR ADJUSTMENT

The LAMINUM® Shim is made up of layers of .002 or .003 inch brass or steel, metallically bonded together over their entire surfaces. Peeling laminations with a penknife gives simple, accurate adjustment; no counting or miking is necessary. Shim is rigid, easy to handle, less compressible than solid metal. No grit can lodge between layers. Available in from 3 to 63 laminations.

THE LAMISOL* SHIM

FOR QUICK, ASSEMBLY LINE USE

The laminations of the LAMISOL Shim (in brass only) are joined by spot-soldering. This type of shim is just right for high speed, repetitive assemblies, regardless of the shim size involved. Spot-soldering makes a very firm "pack," but the laminations are quickly removed. Laminations within the same shim do not need to be all the same gauge, nor is the maximum number of layers limited.

THE LAMITAB* SHIM

FOR SUPER SPEED, THIN GAUGE SITUATIONS

The LAMITAB Shim is a patented exclusive developed by us for the extremely fast moving production line. The little tab holds the shims together firmly, yet is easily removed. Different metals can be used in the same shim. The LAMITAB Shim is unsurpassed, cost-wise and time-wise when properly engineered. Maximum number of laminations is 4, to a total thickness of .010 inch.

THE LOOSE LEAF SHIM

FOR UNLIMITED FLEXIBILITY

The loose leaf shim is the simplest of all custom-stamped shims. It is completely flexible. There is no limit on number or gauge of each shim — and an occasional situation will require this "wide open" adjustment. In such cases, sets incorporating a variety of gauges are made up. Then, by removing one gauge and inserting another, a full scale of fine gauge adjustment is made possible.

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Our Packaged Shim Stock is available for maintenance work from your Industrial Distributor. 6" x 100" roll feeds through package slots, *as it's used*. Available in 11 gauges, from .001 to .010", brass and steel. Heavier gauges to .032 are packed flat, two 6 x 25" sheets to an envelope. Laminated shim stock for maintenance use is also available in a variety of thicknesses and lamination arrangements.

*T.M. Applied For

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Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Clifton Hydraulic Press Co., Clifton, N. J.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.

PRESSES, Sheet Metal Working

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc, 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.

(*Continued on page* 416)

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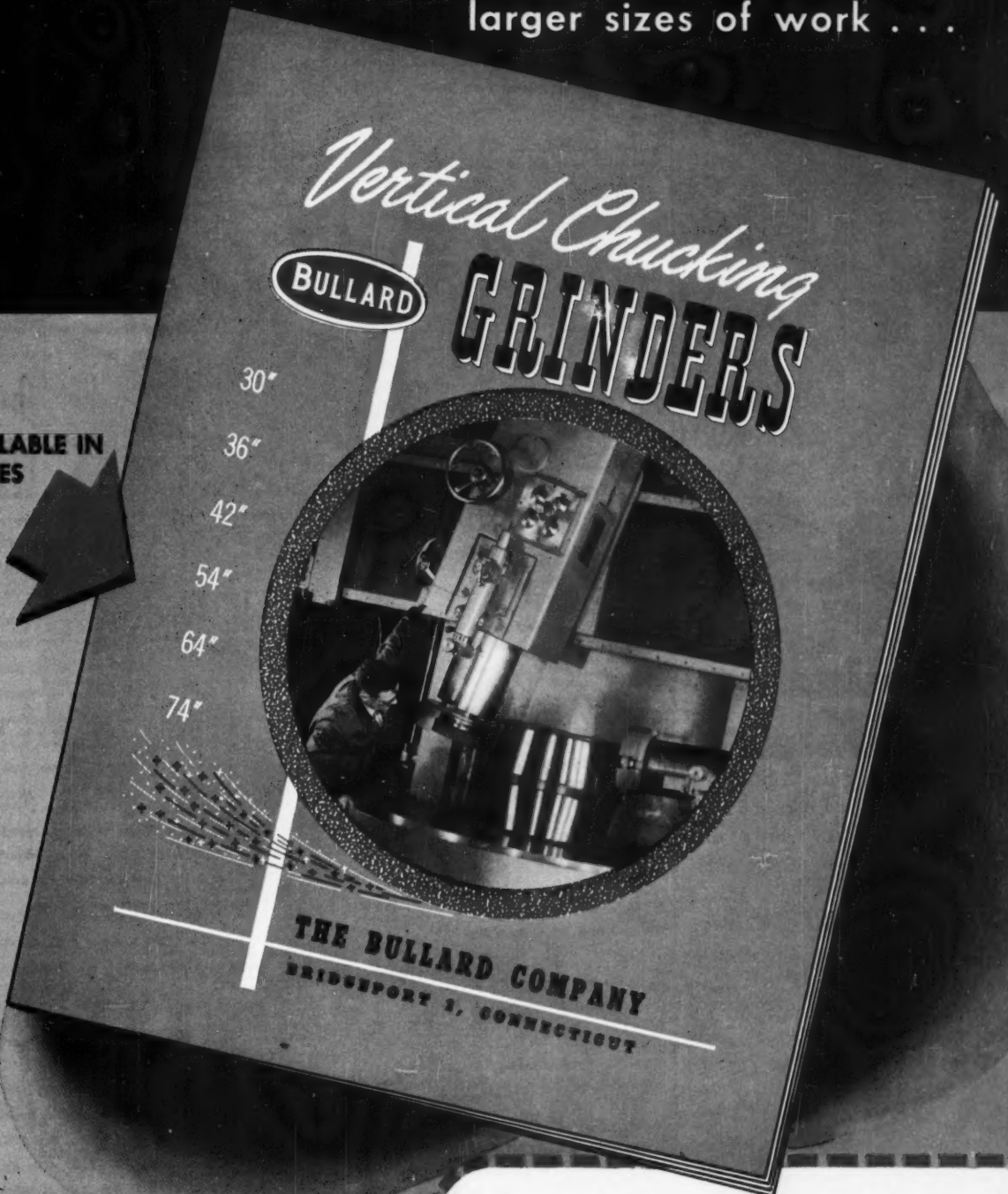

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Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave. Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Bath, Cyril, Co., 6934 Machinery Ave., Cleveland 3, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
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(*Continued on page* 418)

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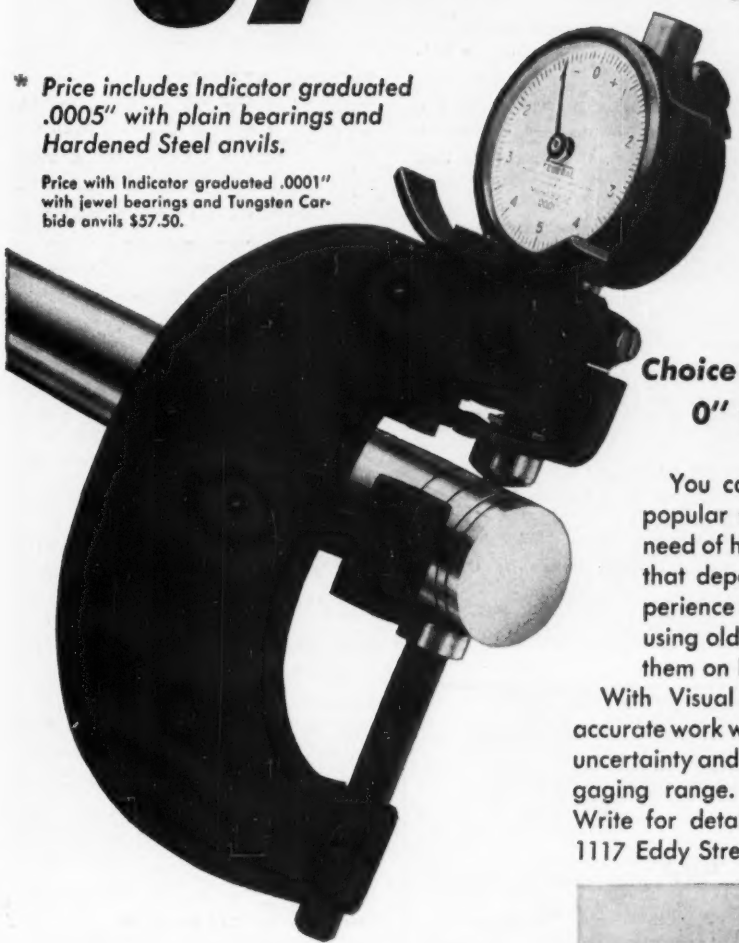

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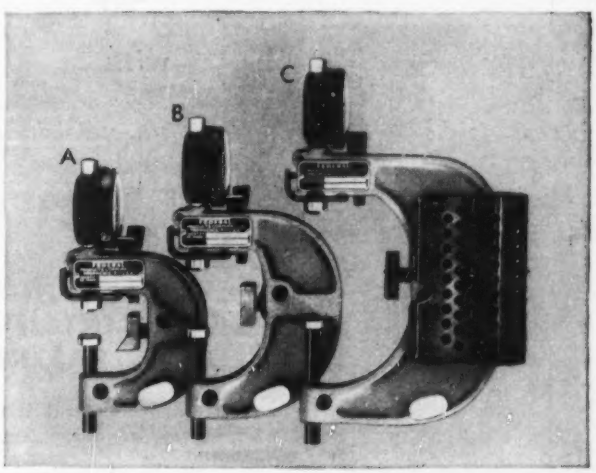

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Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
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Union Twist Drill Co., Athol, Mass.

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Kaufman Manufacturing Co., Manitowoc, Wis.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
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Van Norman Co., 3640 Main St., Springfield 7, Mass.

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Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
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Peck, Stow & Wilcox Co., Southington, Conn.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic
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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
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Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
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Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
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Tomkins-Johnson Co., Jackson, Mich.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

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RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
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Starrett, The L. S., Co., Athol, Mass.

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See Blast Cleaning Equipment.

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Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

(*Continued on page* 420)

QUALITY UP rejects and costs down with

PRECISION MACHINE WORK
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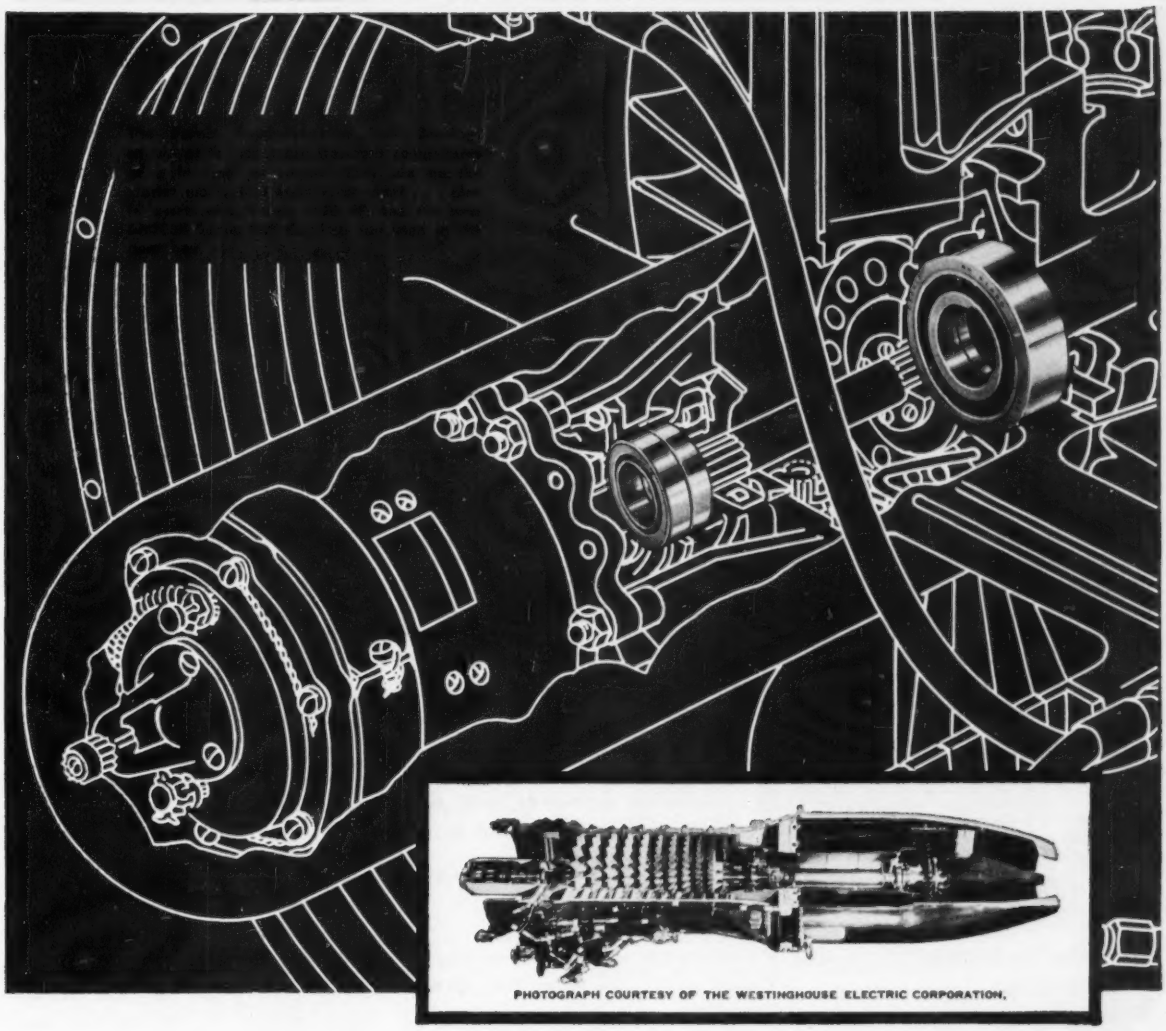
Spun CENTRIFUGAL CASTINGS

To seal Freon gas under pressure was a headache for one concern until they turned from washers made from porous sand castings to the use of leak-proof Non-Gran *Spun* Centrifugal Castings. Rejects dropped from a costly 35% to practically nil. After four years the company continues to use Non-Gran *Spun* Centrifugal Castings. Take advantage of their greater resistance to wear, fatigue, shock and abrasion to lower your costs, improve your product. Request booklet, write: American Non-Gran Bronze Co., Berwyn, Pa.



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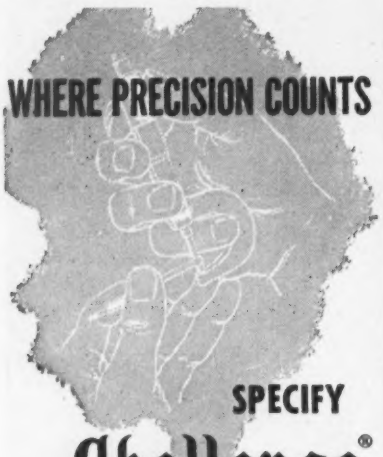
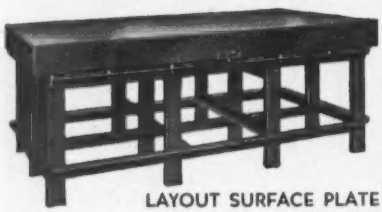
Through continuous research and collaboration with aircraft design engineers, Fafnir keeps in step with aircraft developments . . . and maintains leadership in the production of aircraft bearings. The experience gained, adds to Fafnir's general fund of knowledge that contributes so much to the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the designer's viewpoint, an ability to supply the right bearing for the need. The Fafnir Bearing Company, New Britain, Conn.





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SAWING MACHINES, Metal Cutting Band

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DoAll Co., 254 Laurel Ave., Des Plains, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable.)
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

(*Continued on page* 422)

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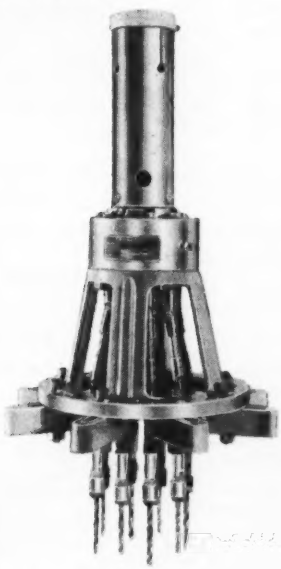
From Errington . . . pioneers in the development of hi-speed production tools . . . comes the new UNIVERSAL JOINT DRILLING HEAD. This dependable tool is adjustable to any pattern of holes . . . and is available with 4 to 12 spindles. The head features all aluminum housing construction, thrust bearings and gears turned on spindles.



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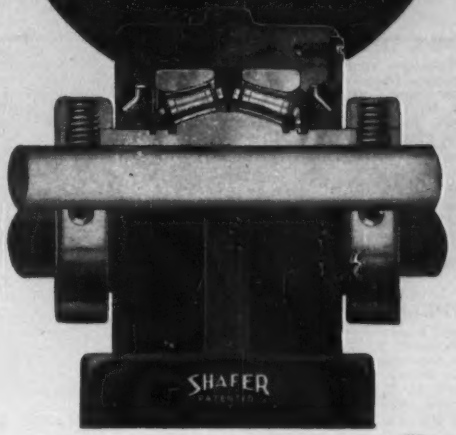

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Shafer Bearings handle these tough jobs better because they are engineered to-the-job—to provide *longer* life, *greater* dependability and *lower* operating costs under the severest working conditions. Integrally self-aligned, they have full radial-thrust and greater reserve shock load capacities under all conditions of misalignment; are equipped with self-centering "Z" housing seals and Micro-Lock 12-point adjustment. See the Shafer bearing specialist near you . . . or write us direct . . . for complete information and engineering consul on a no-obligation basis. SHAFER BEARING CORPORATION, 801 Burlington Avenue, Downers Grove, Illinois.

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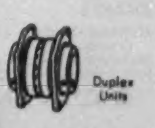
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SELF-ALIGNING

ROLLER BEARINGS

Take-Up and Frame Units

Aircraft Control Bearings

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

SCREWS, Thumb

Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T. & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS

National Forge & Ordance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Corp., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Corp., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist & Drill Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Baldwin-Lima-Hamilton Corp., Philadelphia 42.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.

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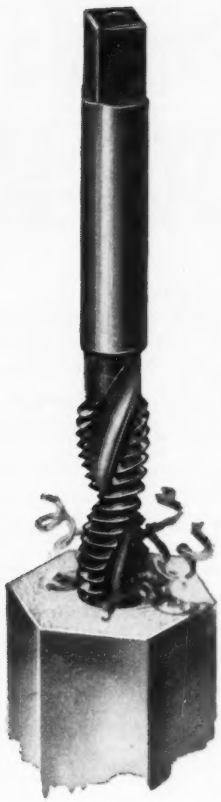

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3HW53A

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
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(*Continued on page 426*)

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U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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STEEL BARS

See Bars, Steel.

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(*Continued on page* 428)

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Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reid Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Salvo Tool & Engineering Co., 26441 Gratiot Ave., Roseville, Mich.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

(*Continued on page* 430)

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For Jobs up to ¾" Bolt Size

STALL TORQUE: 1.8 to 83 ft. lbs.

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These easily operated Compressed Air Angle Wrenches are designed solely for the quick application and removal of nuts in confined areas; areas where the use of other types of nut-runners is impossible.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planing Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Lovejoy Tool Co., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Milholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 Wheeler St., Springfield, Ohio.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Colonial Broach Co., Detroit 13, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
O. K. Tool Co., Milford, N. H.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Metal Corp., Lexington, Ky.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TRANSFER MACHINES, Automatic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page* 434)

small parts production increased with

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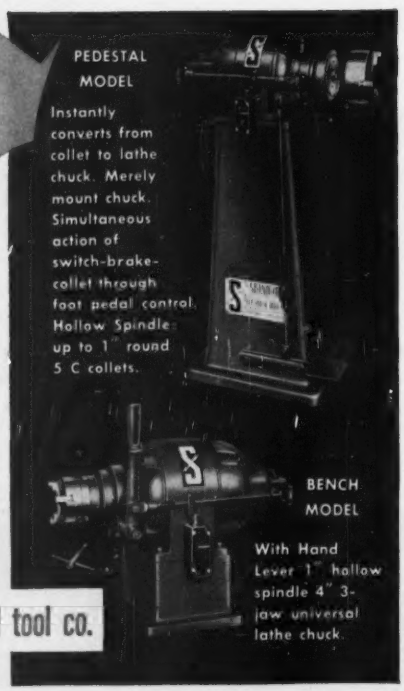
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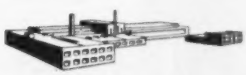

PLANT 2
Detroit, Mich.

PLANT 3
Hillsdale, Mich.

PLANT 4
Hillsdale, Mich.

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COMPANY_____

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General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES
American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

TUBING, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS
See Drills, Twist.

UNIVERSAL JOINTS
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

VALVE CONTROLS
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air
Bellows Co., 230 W. Market St., Akron, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

VIBRATION INSULATION
American Felt Co., Glenville, Conn.

VISES, Machine
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bellows Co., 250 W. Market, Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand, Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
L-W Chuck Co., 24 S. St. Clair, Toledo, O.
Martin, J. E., Mch. Works, 548 W. State St., Springfield, Ohio.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Martin, J. E., Mch. Works, 548 W. State St., Springfield, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS
General Electric Co., Schenectady, N. Y.

WASHERS, Lock
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York.

WELDING EQUIPMENT, Electric, Spot,
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
American Electric Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 641G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS
Mahon, R. C., Co., Detroit 34, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

WIRE
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY
Delta Power Tool Div., Rockwell Mfg., Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleco Div., Reed Roller Bit Co. (Impact, Pneumatic), 5125 Clinton Ave., Houston 20, Tex.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Detachable Socket
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Peck, Stowe & Wilcox Co., Southington, Conn.

WRENCHES, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.

WRENCHES, Tap
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Torque Measuring
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
Sturtevant, P. A., Co., Addison, Ill.

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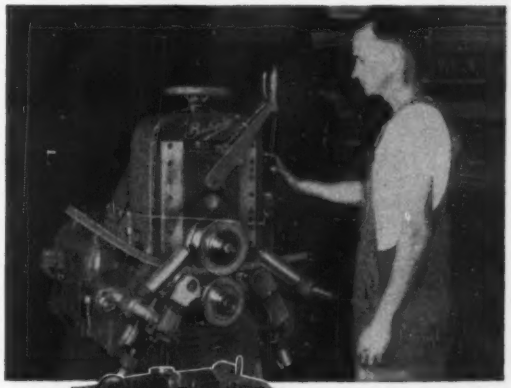
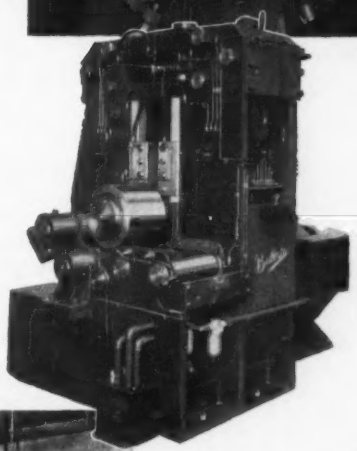


Above, a "Buffalo" Type OA Aircraft Bending Roll.



Left, a "Buffalo" Wrapping Roll

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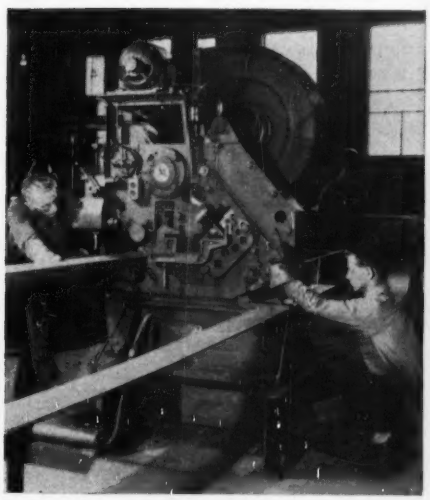
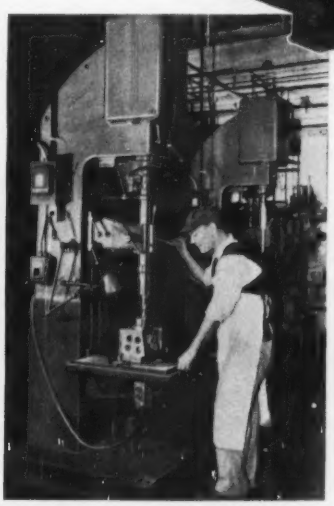
• You can cut, punch, shear, notch and cope angles, tees, beams, flats and channels with rugged, versatile "Buffalo" Universal Iron Workers! Complete range of sizes to fit *your* operations. Write for Bulletin 360 today!



No. "0" Universal Iron Worker



"Buffalo" Motor Spindle Drill

DRILLING OUTPUT *Gets A Lift!*

• "Buffalo" Drills are high quality machines with all controls easily reached and all setup and speed adjustments easily made. There is a full line for every job you have—from the smallest sensitive drill to the big 99" high Motor Spindle Drills you see at the left. Complete details on request.

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co, Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

FABRICATORS AND ERECTORS OF STRUCTURAL STEEL

FOR 65 YEARS

for POWER PLANTS . . . such as the new U.S. Rubber Co. installation at Mishawaka, Indiana, illustrated above. We have supplied structural steel and hoppers for many power plants throughout the country.

COMMERCIAL BUILDINGS and INDUSTRIAL PLANTS—Warehouses, office buildings, manufacturing and processing plants.

CHURCHES AND INSTITUTIONAL BUILDINGS, including hospitals, research laboratories, penitentiaries, arsenals and other government projects.

BRIDGES . . . for railways, and highway bridges for local, state and federal governments.

CONVEYOR FRAMES, COMBUSTION SYSTEMS, HOPPERS and all types of custom-built industrial installations.

When it comes to Structural Steel, you can count on Hansell-Elcock. In addition to fine craftsmanship and unsurpassed fabricating facilities, we assure you of *deliveries on schedule* and excellent service. For sixty-five years our business has been built on a deep sense of responsibility to our customers.

Structure Controlled Gray Iron Castings

If you manufacture

Machine Tools • Presses
Diesel Engines • Air Compressors
Material-Handling or
Miscellaneous Machinery . . .

If you need

Quality Castings in Small or Large Quantities, in Weights from 50 Lbs. to 20 Tons Each . . .

Rely on Hansell-Elcock for

Structure Controlled Gray Iron Castings • Excellent Machinability • Complete Metallurgical Control • Dimensional Uniformity Rigid Inspection • Low Cost

Give us a call

STRUCTURAL STEEL • GRAY IRON CASTINGS

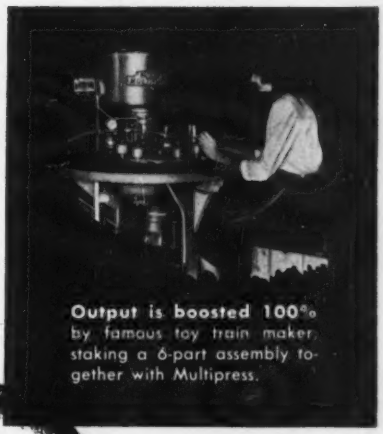
HANSELL-ELCOCK COMPANY

SERVING INDUSTRY SINCE 1888

485 WEST 23rd PLACE • CHICAGO 16, ILLINOIS

Assembly speed is doubled using Multipress to crimp a small brass contact to pen-type flashlight cases.

Scrap losses drop sharply as Multipress doubles staking speed on high precision voting-machine counter wheel assembly.



Output is boosted 100% by famous toy train maker staking a 6-part assembly together with Multipress.

MULTIPRESS® DOUBLES PRODUCTION SPEED

On Six More Typical Operations

Faster production, better quality, less scrap, safer operation, easier handling, quieter action, and other profit-boosting results are run-of-mine with Multipress.

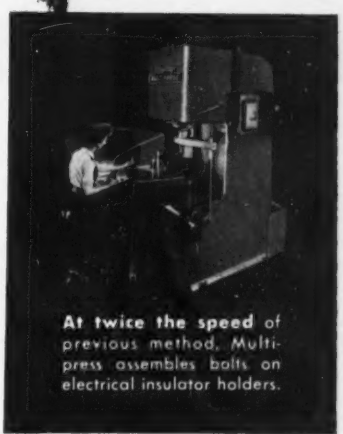
In the six cases shown here, Multipress *doubled* production rates. Hundreds of other reports tell of gains ranging up to 8 and 10 times the speed of previous equipment.

How does Multipress do it *so consistently?*

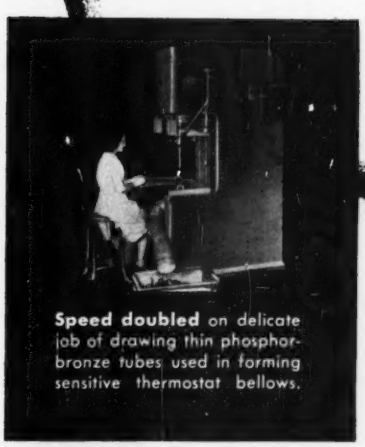
It is uniquely engineered to provide the smooth, controlled action of oil-hydraulic power *at its versatile best!* Infinitely adjustable ram pressures and stroke length make it easy to eliminate all unnecessary ram *travel* and ram *effort. Controlled* ram speed eliminates hammer-blow impact, cuts wear and tear on tooling, and permits better metal flow.

Multipress also offers standard attachments for extra efficiency on most production needs. It is easily equipped with automatic feeds, indexing tables, ejection devices, auxiliary ram actions . . . controls for automatic time-delay, hold-down, vibratory pressure application, sequence operations, etc. Multipress offers nine frame sizes . . . one-ton to 75-ton capacities. Write for details!

In only four stages, Multipress deep-draws a precision ordnance part formerly requiring 8 draws.



At twice the speed of previous method, Multipress assembles bolts on electrical insulator holders.



Speed doubled on delicate job of drawing thin phosphor-bronze tubes used in forming sensitive thermostat bellows.

DENISON Hydr OIL ics

The DENISON Engineering Co.

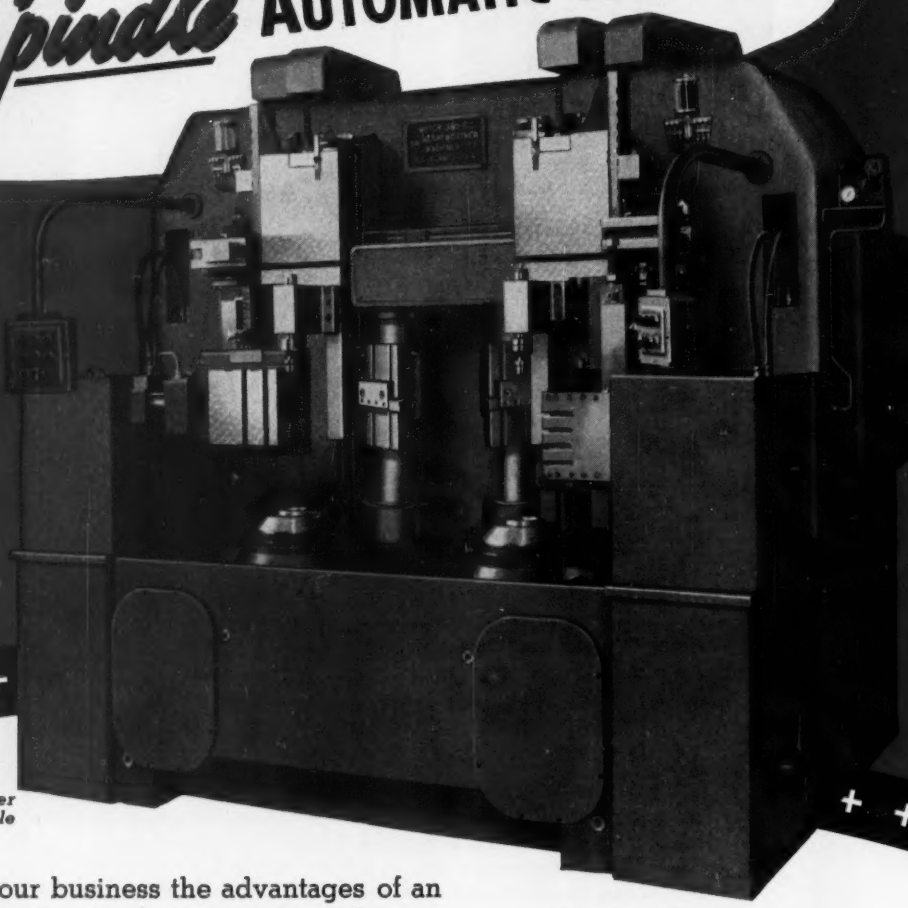
1152 Dublin Road, Columbus 16, Ohio

Obtain *PLUS* Values from the Motch & Merryweather *Twin-Spindle* Automatic Lathe...

GET PLUS PRODUCTION!

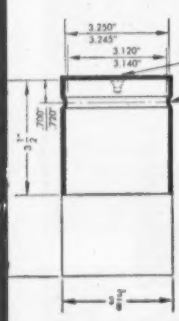
GET PLUS ACCURACY!

GET PLUS PROFITS!



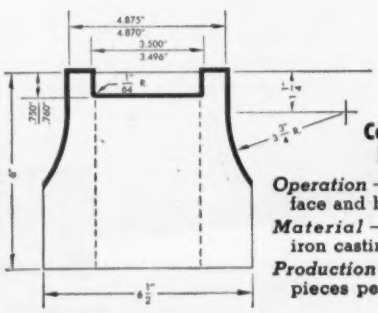
Motch & Merryweather VTBF-12 Twin Spindle Automatic Lathe.

Command for your business the advantages of an automatic turning-boring-facing cycle with precision – *plus* the value of *twin yet independent* spindles – *plus* the value of vertical facility for handling parts. These machines are accurate, rugged, and dependable, yet simple to set up.



Case Study No. 96

Operation – Turn, face, groove and center drill.
Material – SAE 1335 annealed.
Production – 124 pieces per hour.



Case Study No. 124

Operation – Turn, face and bore.
Material – Gray iron casting.
Production – 60 pieces per hour.

STANDARD SPECIFICATIONS

Chuck diameter	10"
Swing	12" dia.
Work height: chucking	12"
between centers	16"
Turning slide, vertical feed	14"
Boring slide, vertical feed	14"
Facing slide, horizontal swing	6"

★ ★ ★

Individual, selective hydraulic feed for each slide. . . . Special variations to meet individual requirements. . . . Simple contours by cam-operated tools. . . . Tracer control can be added.

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —
CLEVELAND 13, OHIO
Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

lower
NEW PRICES
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SAME QUALITY

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Every sprocket user will want this new, up-to-the-minute 48-page book of buying information on . . .

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New LOWER prices, based on larger volume, and on engineering and production economies, mean substantial savings for all sprocket buyers, whether typical order is large or small.

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gears and gear assemblies
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and tractors

make AMgears
your
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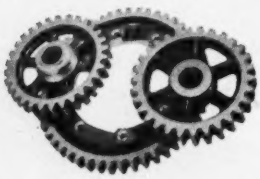
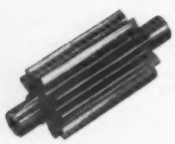


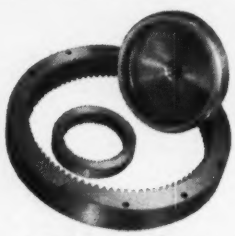
for power shovels

gears for
aircraft

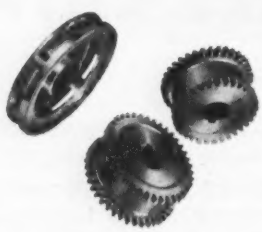


ground tooth pump gears
for diesel engines

worm gears for hoists



internal gears for engines
and transmissions



special gears
and gear assemblies

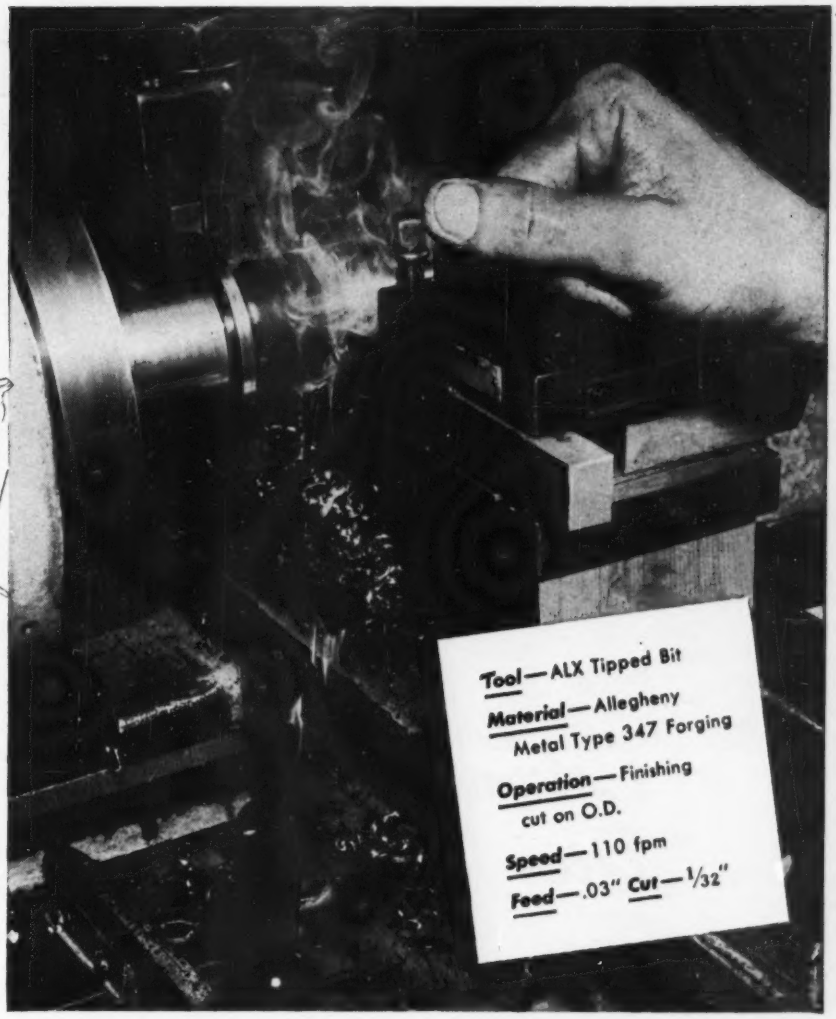
AM ACCURATELY MADE gears, INC.
A SUBSIDIARY OF HUPP CORPORATION

CLEVELAND • DETROIT • CHICAGO

2 big plants for gears and gear assemblies with a customer list that reads like Who's Who in American Industry.

CHICAGO 6633 WEST 65TH STREET, CHICAGO 38
DETROIT 7450 MELVILLE, DETROIT 17

Want Faster Cutting? Fewer Grinds?



. . . then get ALX ALLOY Cutting Tools

Write for copy of

"ALX ALLOY TOOL BITS"

An eight-page booklet tells how you can effect production economies by using ALX for fast turning, boring, and facing—in certain applications. Helpful information includes grinding, tool angles, speeds and feeds, brazing of tips. *Write for your copy.*

ADDRESS DEPT. M-43.

Many a machine shop—and probably yours—has jobs on which ALX Tipped Tools or ALX Solid Bits step up production by permitting increased speeds, feeds, and depths of cut. Resharpening is less frequent, the reason being special composition.

ALX is a cast-to-shape, non-ferrous, cobalt-base alloy containing chromium, tungsten, carbon, and boron. The as-cast hardness of 60-62 Rockwell C obviates later heat treatment. Tools stay sharp at accelerated speeds and higher temperatures. Speed range is above that of high-speed steel, but lower than with carbide. At such intermediate speeds, the superior performance of ALX results from toughness, red-hardness, edge-strength, and abrasion-resistance values combined.

An Allegheny Ludlum tool engineer can quickly point out the strategic spots to tool up with ALX. For this service, call A-L. ● *Allegheny Ludlum Steel Corp., Forging & Casting Division, Wanda & Jarvis Aves., Detroit 20, Mich.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

WAD 3485

AL FINE TOOL STEELS SINCE 1854

production begins with

Columbus Die-Tool

It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

Let Columbus Die-Tool's more than 46 years of designing and engineering experience go to work for you. Contact CDT today about your special die, tool and machinery requirements.

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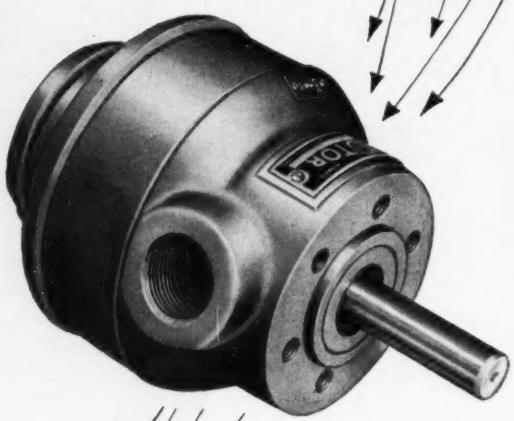
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

the "label" tells you it's unique



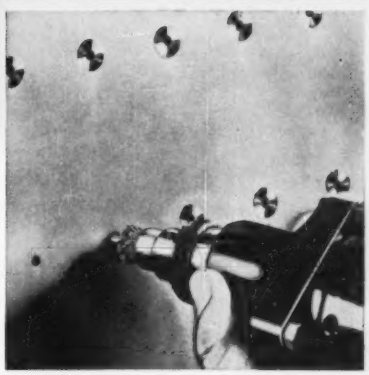
no other hydraulic pumps are like

See the Gerotor name-plate on a hydraulic pump and you know what's inside . . . the renowned Gerotor mechanism. Both elements revolve in the same direction at low relative speed . . . minimizing friction, wear and slippage . . . assuring longer life, smoother flow, higher efficiency at lower operating cost. Eleven pump sizes, some engineered for pressures up to 1200 p.s.i. continuous, 1500 p.s.i. intermittent. Specify Gerotor!

Gerotor May Corp., Box 86, Baltimore 3, Md.

GEROTOR
HYDRAULIC PUMPS

OSBORN



Osborn wire brush, automatically located, removes zinc chromate from around rivet holes in aircraft production.

Which of these versatile brushes will cut your costs?

Hard-to-get-at jobs are simplified . . . costly hand operations are eliminated . . . when you switch to one of these special-purpose Osborn power brushes.

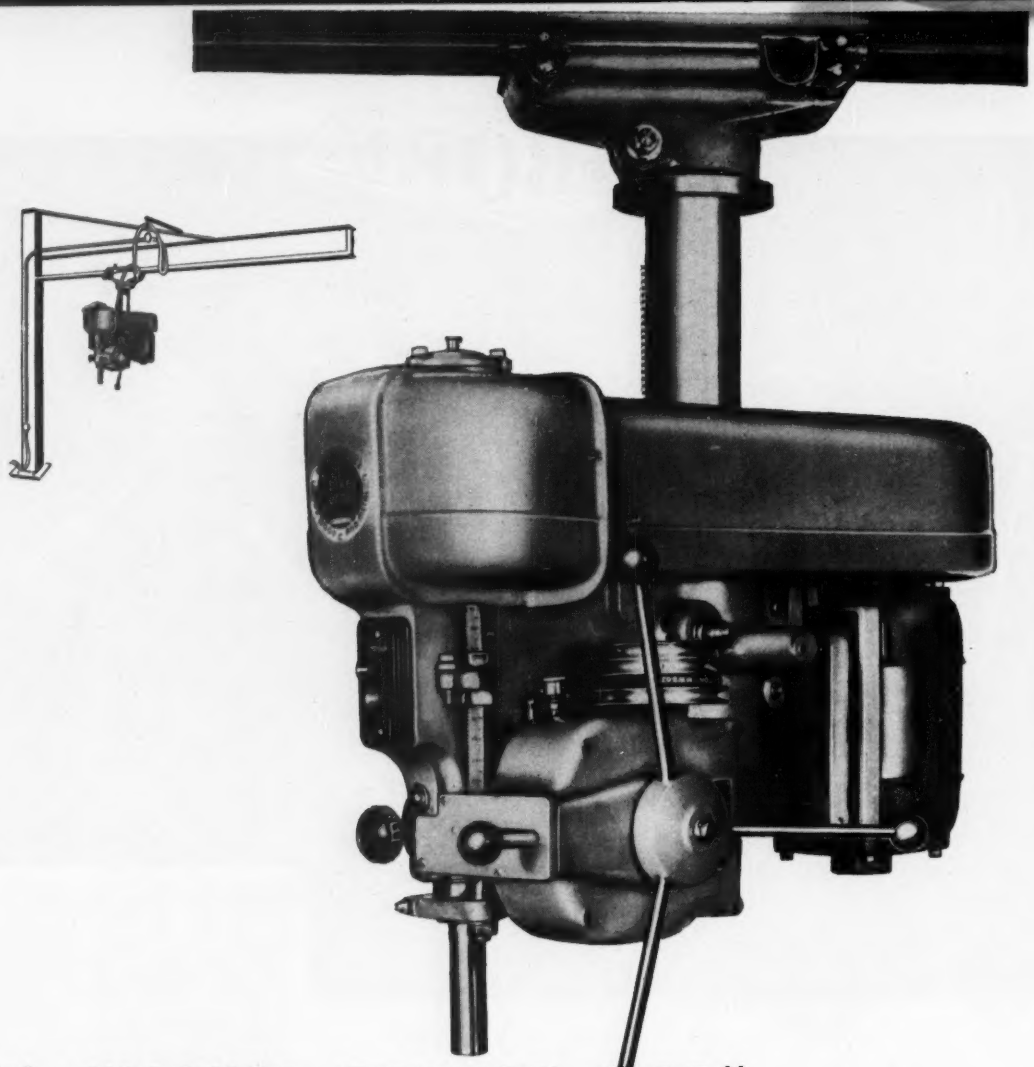
These versatile wire brushes are just a few of the complete Osborn line of power brushes for every need. Your **O**sborn **B**rushing **A**nalyst will gather necessary facts in your plant . . . study your production equipment and recommend the most efficient, economical power brushing techniques.

The small Osborn brush shown in operation enables one man to do the work of seven men. Output per man went up 700% in this aircraft application of removing zinc chromate priming from around rivet holes in wings and fuselages. Formerly this job was done by hand with small sandpaper discs.

Such results are duplicated every day by **O**sborn **B**rushing **A**nalysts. They can solve *your* brushing problems of product cleaning, burr removal, roughing, polishing or finishing with similar startling economies. For complete information at no cost, call your nearby Osborn representative or write to *The Osborn Manufacturing Company, Dept. D-7, 5401 Hamilton Ave., Cleveland 14, Ohio.*

Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES



This WALKER-TURNER 20" OVERHEAD DRILL PRESS SET-UP

saves handling time . . . cuts costs

Wherever large or heavy parts or units are to be worked, this set-up—utilizing a WALKER-TURNER DRILL HEAD with its special ball-bearing carriage traveling along a boom—can save handling time and costs . . . bring new production economies. Special set-ups like this make it possible to get WALKER-TURNER precision drilling (either hand or power feed) at surprisingly low cost.

WALKER-TURNER

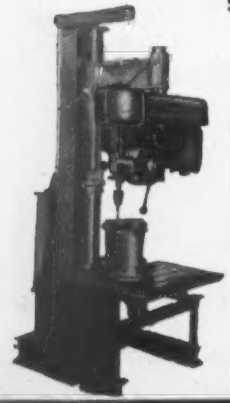
walker-Turner • DIVISION •

KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES—Hand and Power Feed • RADIAL DRILLS • Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS • RADIAL SAWS JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS • BELT and DISC SURFACERS • FLEXIBLE SHAFT MACHINES

SOLD ONLY THROUGH *TRAINED* INDUSTRIAL DISTRIBUTORS



Almost Unlimited Application

WALKER-TURNER Drill Heads may be used for almost unlimited applications. The illustration left shows a set-up in daily use performing as a radial drill of extra large capacity.

Horizontal and angular mountings—in single units or in batteries—are making substantial savings for hundreds of manufacturers.

For complete information, write your name and address in the margin of page.

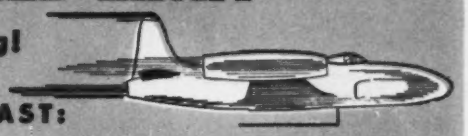
Use this space

to write for full details and specifications.
Walker-Turner Division, Kearney & Trecker Corp.
Dept. M7, Plainfield, N. J.

(Please write your name and address in margin of page)

today, you're hardly aware of any **SPEED LIMIT** *

on surface broaching!



BUT HERE'S WHAT IT'S BEEN IN THE PAST:

6 fpm 1902

25 fpm 1922

60 fpm 1942

today 300 fpm . . . and more!

* Of course we're talking about the new LAPOINTE ELECTRO-MECHANICAL DRIVE horizontal BROACHING MACHINE

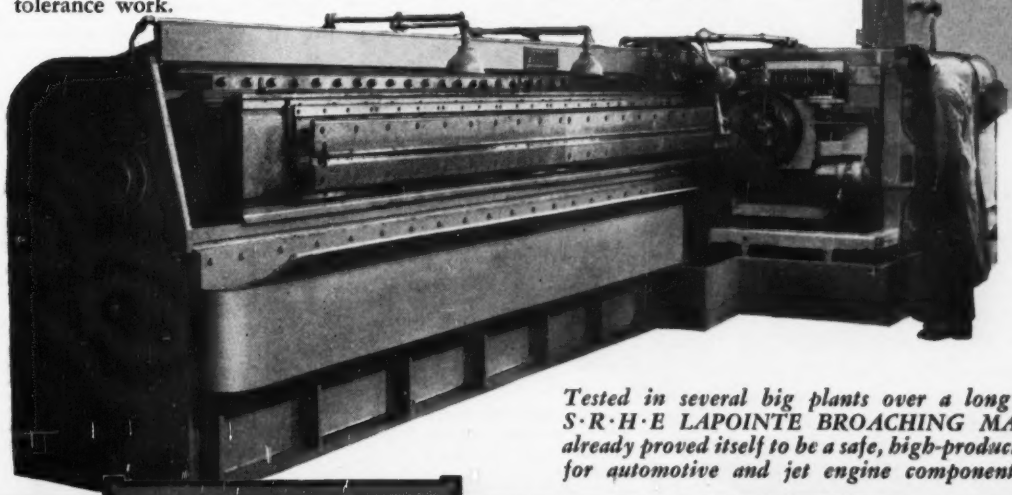
Enthusiastic approval of this new LAPOINTE BROACHING machine has been given by some of the best people — and best plants — in America! How? *They said it with orders!*

These orders came, because some plants wanted the greater flexibility and versatility now available through the Dual Speed and Dual Cycle (patented) features;

Some plants needed the higher production now possible in a modern high-speed broaching machine;

And all plants were delighted to know about the longer strokes that were available, **100" to 180",** providing single pass broaching operations for close tolerance work.

Write for new Technical Bulletin SRHE-1



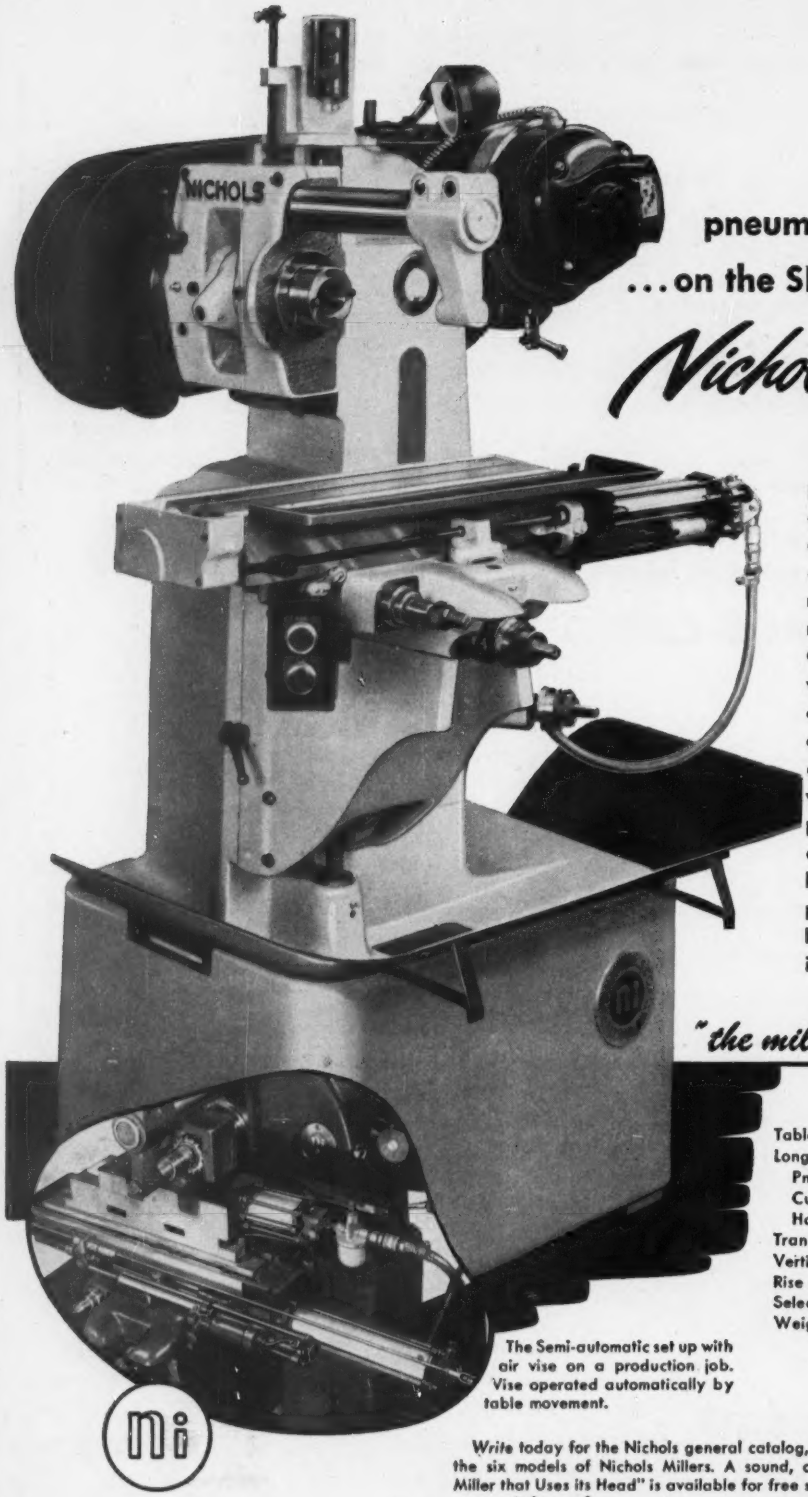
Tested in several big plants over a long period, the S·R·H·E LAPOINTE BROACHING MACHINE has already proved itself to be a safe, high-production machine for automotive and jet engine components especially.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



pneumatic feed — for speed ... on the SEMI-AUTOMATIC

Nichols Miller

In selecting the Nichols Miller with pneumatic table feed, you obtain precision and a high-production semi-automatic machine. The push-button controlled power feed is entirely automatic — leaves the operator free to merely load and unload the work. Often he may run two or three millers with ease. The air cylinder works against the cutter *and* the hydraulic cylinder — completely eliminating chatter and table jump. The unit provides rapid advance from loading position to the cutter, infinitely variable cutting feed, and rapid return to loading position. Also available with power vertical feed to spindle head. If you want high production to "tenths", investigate the Nichols Semi-automatic!

"the miller that uses its head!"

CONDENSED SPECIFICATIONS

Table Working Surface	6¼" x 21"
Longitudinal Travel	
Pneumatic	9"
Cutting Stroke	5⅜"
Hand Screw (Optional)	10"
Transverse Travel	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

The Semi-automatic set up with air vise on a production job. Vise operated automatically by table movement.

Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

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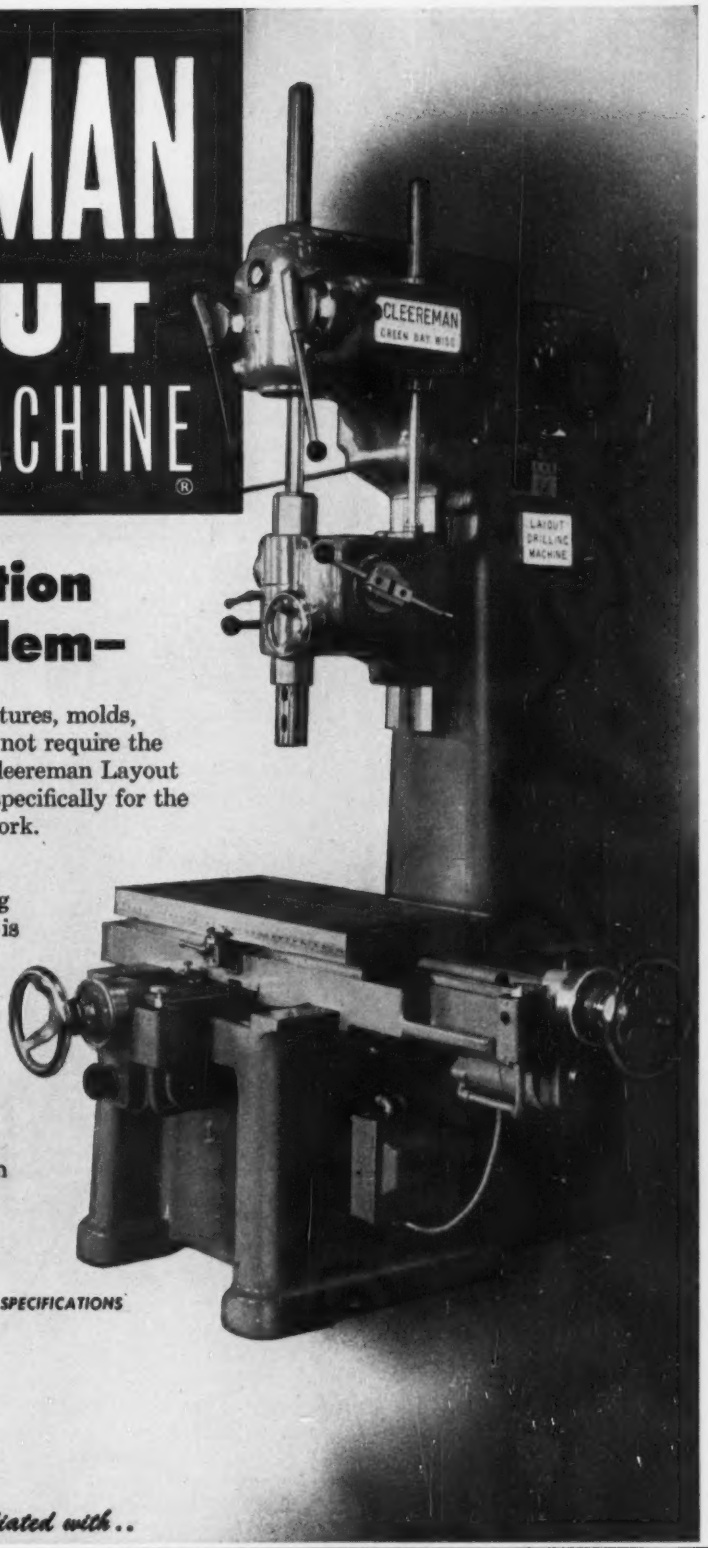
CLEEREMAN LAYOUT DRILLING MACHINE®



A Modern solution to an Old Problem—

A large portion of tools, dies, jigs, fixtures, molds, jig-less production and other jobs do not require the ultra-precision of a Jig Borer. The Cleereman Layout Drilling Machine has been designed specifically for the efficient handling of this particular work.

Built with many features of design similar to those used in Cleereman Jig Borers, the Layout Drilling Machine is an economical machine capable of accurately locating, drilling, boring, reaming, tapping, etc., with the utmost of operator ease, at a fast rate of production over a long period of time.

Cleereman standards of high quality and proven engineering design and material selection have been maintained in every detail.

WIRE OR WRITE FOR CATALOG WITH COMPLETE SPECIFICATIONS

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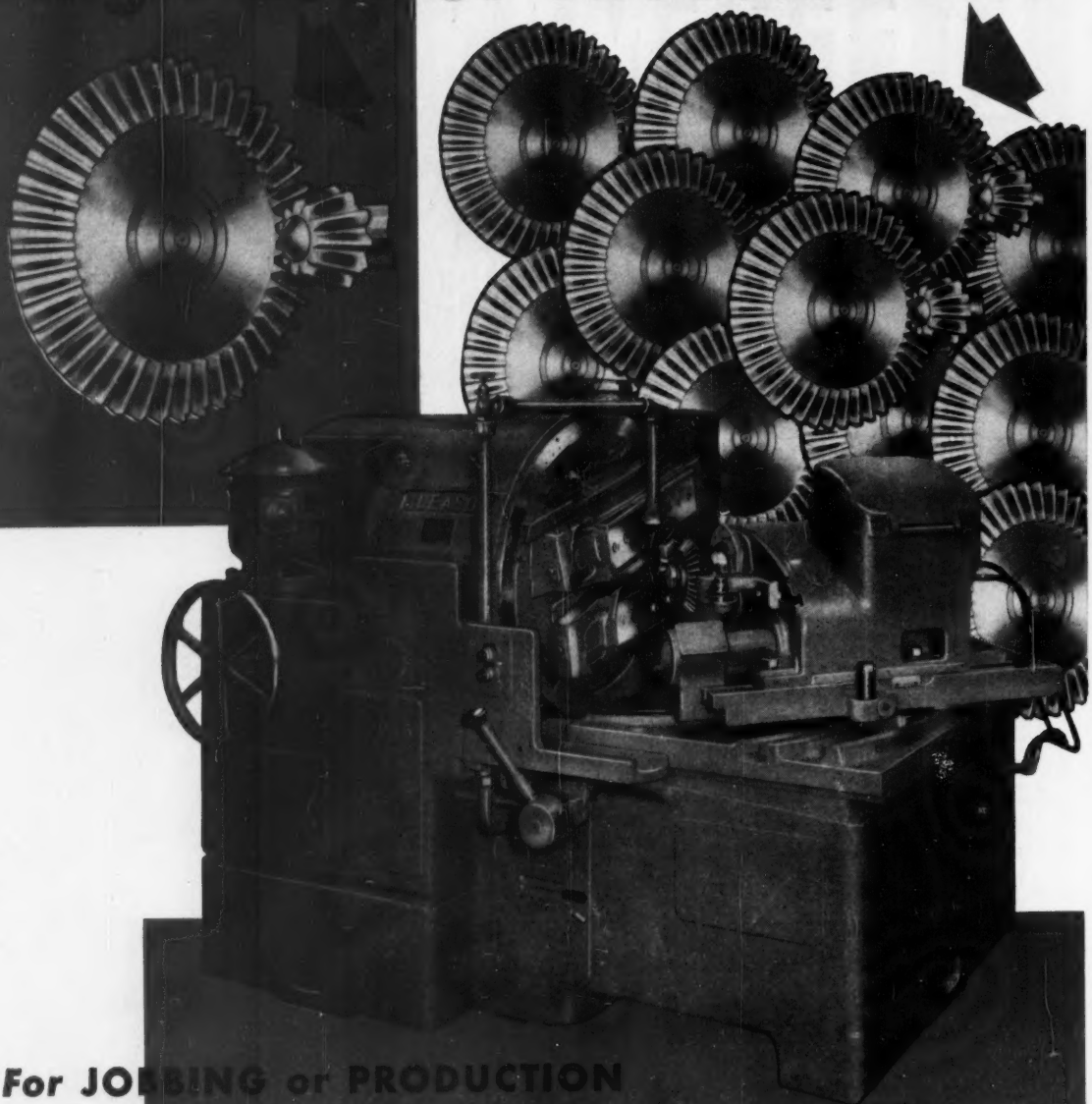
CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

Single Lots or Thousands...



For JOBBING or PRODUCTION the GLEASON No. 14 STRAIGHT BEVEL GENERATOR LEADS THE WAY

It is universal within its range . . . is easily set up and changed from one job to another . . . equipped with double track cam for roughing and finishing . . . handles gears up to 24" pitch diameter in large or small quantities.

Write for leaflet and see how the No. 14 Straight Bevel Generator will fit your requirements

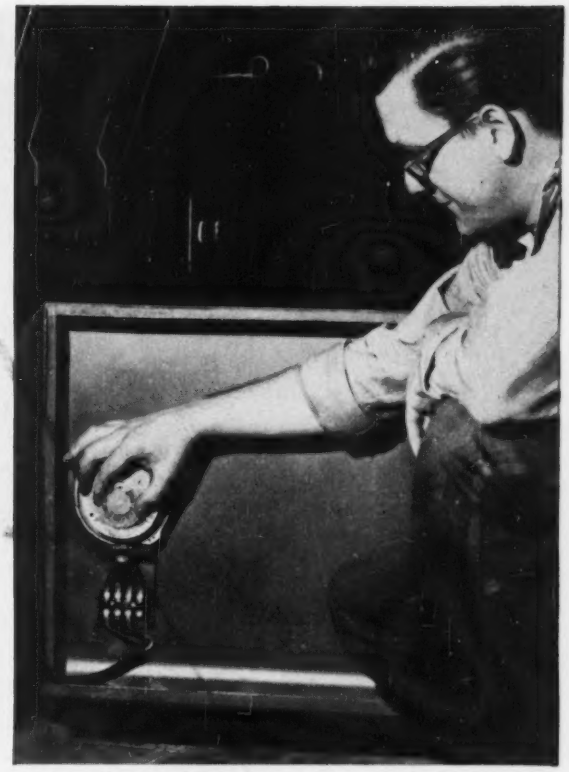
GLEASON

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

AUTOMATIC CONTROL of lubrication pumping system by the unseen G-E process timer releases operator for full-time operation on machine; will automatically increase this machine's life.



ADJUSTING PROCESS TIMER is simple and need be done only once. Here operator adjusts the TSA-14 for lubrication cycle on the basis of a predetermined percentage of operating time.

Here's how you can . . .

Boost Operator Output with a G-E Process Timer

Because of automatic—rather than manually controlled—lubrication, an operator's output is measurably increased, machine life is prolonged, and shut-down time for repairs is reduced to a minimum. Here a General Electric TSA-14 process timer controls a motor and pump, which in turn supplies oil to various parts of the machine. The operation shown above is only one example of the many applications where the precise control provided by this timer saves manpower and prolongs machine life.

MANY APPLICATIONS

"Stopwatch accuracy"—that's how the controlling accuracy of the TSA-14 process timer is described. This preset control provides exact on or off timing for machine operations. Applications for the TSA-14 range from pumping control to the accurate timing required by chemical processes.

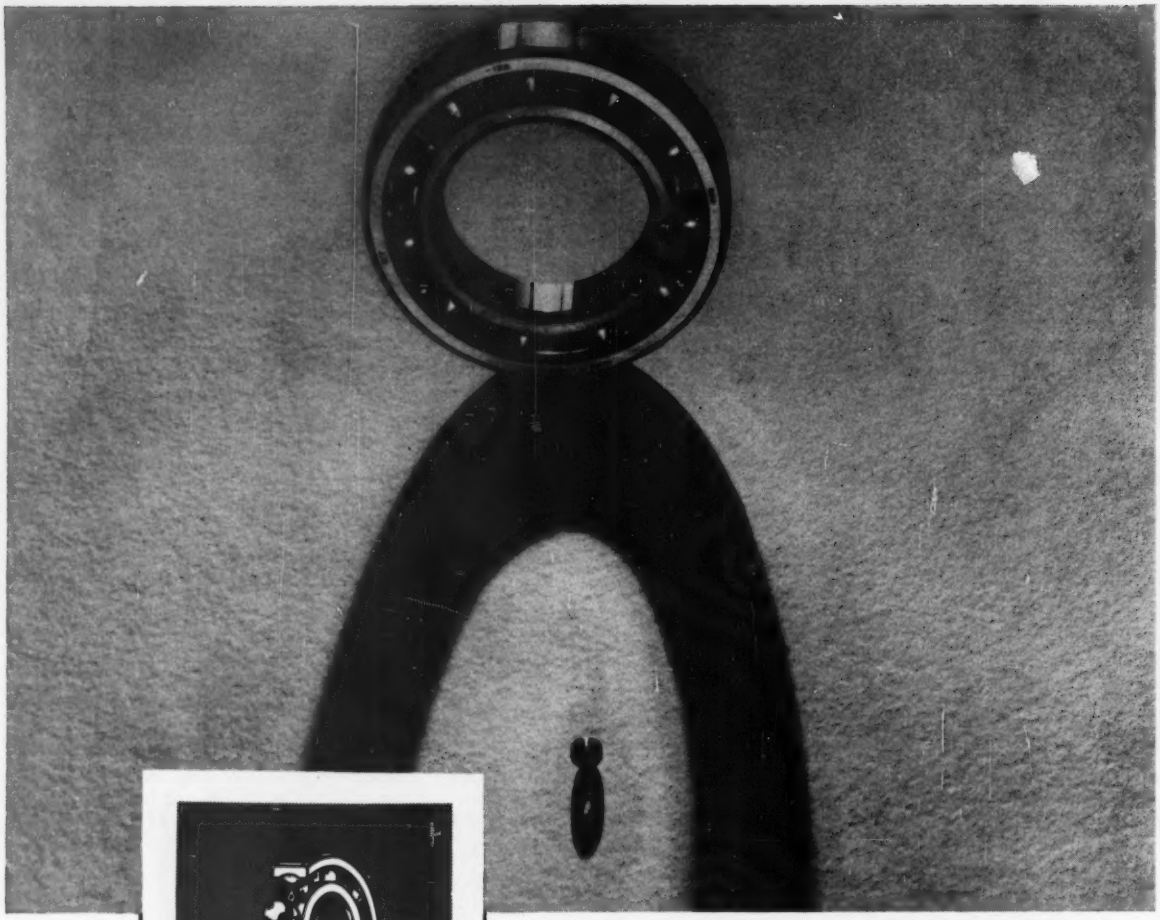
FOR MORE INFORMATION

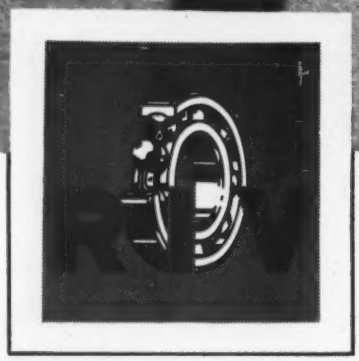
Write or call your nearest G-E Apparatus Sales Office, or Authorized Agent or Distributor. Ask for Bulletin GEC-525. General Electric Company, Schenectady 5, N.Y. 603-165

You can put your confidence in—

GENERAL ELECTRIC

EASY INSTALLATION is yours with the TSA-14, which is equipped with pipe nipple for easy mounting and color code for easy wiring. Write for descriptive publication today!





RIV - OFFICINE DI VILLAR PEROSA
S. p. A TURIN (ITALY)

ESTABLISHED IN 1906: almost 50 years of steady development are a guaranty of wide engineering experience.

3 FACTORIES: at Turin, Villar Perosa, Aquasio, covering altogether an area of 700 000 square meters, constitute an industrial group of high productive possibilities.

100 ENGINEERS: place their technical knowledge and practical experience at the service of every customer.

1500 OFFICE WORKERS: make up an efficient commercial and administrative organization.

9000 WORKMEN: contribute their labor and skill to an ever improving and increasing production.

8000 MACHINE TOOLS: mean an industrial capacity of world importance.

CONTROLS AND INSPECTIONS: carried out at every manufacturing stage ensure an exact conformity of parts to constructional tolerances.

RIV manufacture: Single-row Radial Ball Bearings • Double-row Radial Ball Bearings • Self-aligning Radial Ball Bearings • Single-row Angular-contact Ball Bearings • Double-row Angular-contact Ball Bearings • Cylindrical Roller Bearings • Single-row Barrel-shaped Roller Bearings • Double-row Barrel-shaped Roller Bearings • Needle Roller Bearings • Taper Roller Bearings • Single-thrust Ball Bearings • Double-thrust Ball Bearings • Thrust Barrel-shaped Roller Bearings • Shielded Bearings • Sealed Bearings • Balls, Rollers and Needle Rollers • Pillow Blocks • Tram- and Railway Journal Axle-boxes • Journal Axle-boxes for Small Wagons • All types of special bearings, in every size (metric and inch dimensions), with outside diameters ranging from 10 mm to over 4 meters, for every application.

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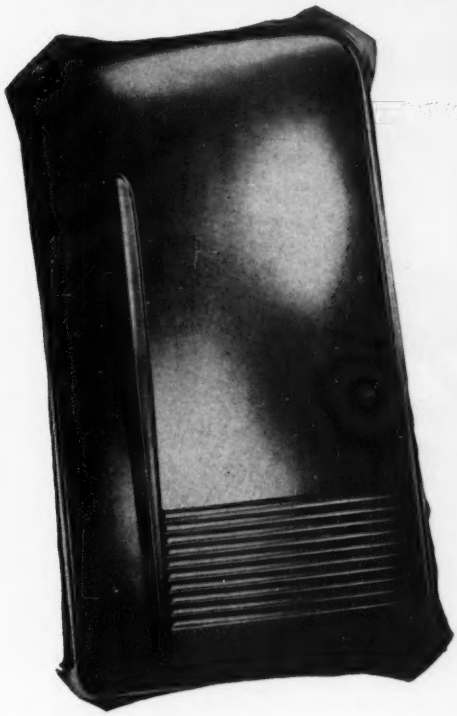

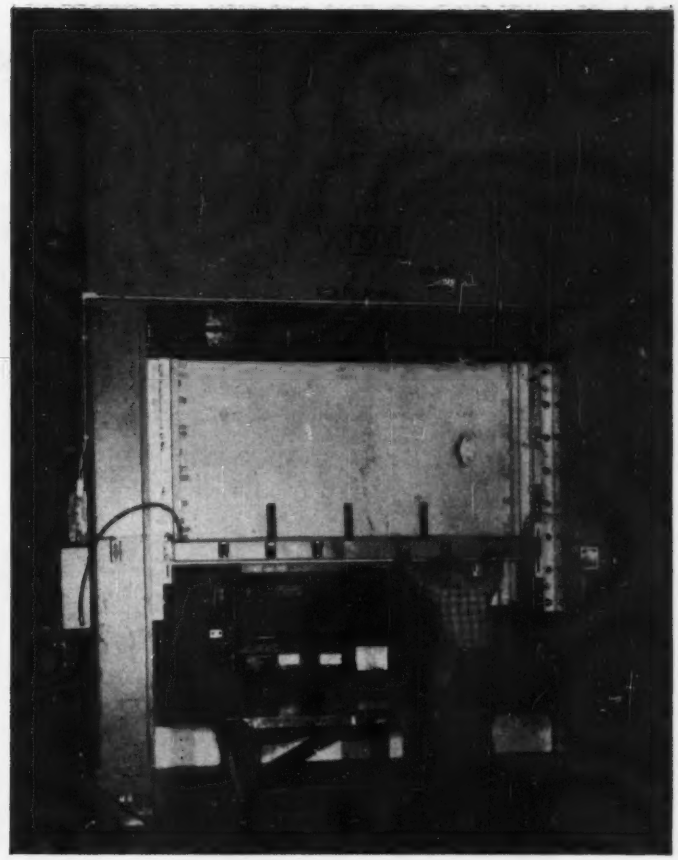

THIS Verson FULL ECCENTRIC PRESS produces refrigerator doors

AT Admiral Corporation's Midwest Manufacturing Division in Galesburg, Illinois, all heavy press and press brake equipment is of Verson manufacture, especially for Admiral. The press illustrated above is typical—a 600-ton Verson full eccentric with two points of power application to produce large pieces such as the refrigerator door shown. Other full eccentrics in the Verson line-up at Admiral range from 200 tons to 600 tons capacity.

For all types of forming of large or small pieces for ranges, refrigerators, freezers, space heaters or what have you, Verson full eccentrics provide the five essentials of press design—strength, rigidity, endurance, accuracy and power. For the user of our presses, it means better stampings at lower overall cost.

Whatever you produce that requires stampings—it will pay you to find out what we can offer you. For recommendations, send an outline of your requirements.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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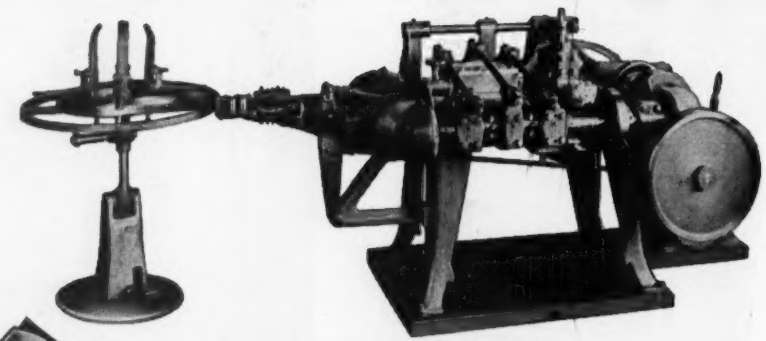
MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

NILSON FOUR-SLIDE

It's easy to get
HIGH PRODUCTION
... and UNIFORMITY, too!

Wire and Ribbon Metal FORMING MACHINES



UNIFORMITY in automatic production doesn't come by chance! In the case of wire and ribbon stock forming on NILSON 4-SLIDES, *it means control of the material from the coil to the final form.*

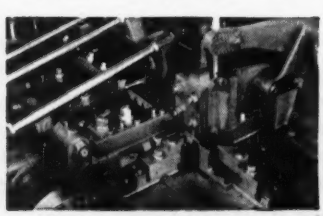
Parts, such as illustrated, are produced to tolerances of .002 at critical dimensions. Dies and forming tools, once installed (faster and simpler with NILSON'S open construction) maintain close tolerances for short and long runs. One machine! One set-up! Increased production! Maximum uniformity!

Model SF3 NILSON 4-SLIDE, shown above, with No. 51B Tilting Stock Reel, is a complete unit that can be set-up in any convenient location.

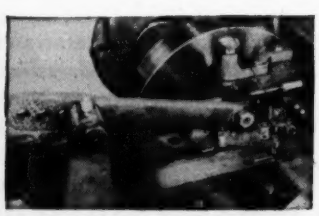
Range of sizes

Wire Forming —
1/32" through ½" wire. Feeds up to 32".

Ribbon Stock Forming —
1" through 3½" wide material. Capacity of press section 5 to 30 tons; 50 to 75 tons in heavy duty types.



Close-up of the NILSON forming section with the built-in Horizontal Press to the left. This design eliminates secondary handling and insures product uniformity because the sequence of stamping and forming is automatically controlled.



Close-up of the NILSON feed mechanism . . . capable of feeding wire and ribbon metal to tolerances of .001. Another important element in insuring product uniformity. Positive control is maintained over the material regardless the length of feed.

For specific recommendations — send details of your operation.

THERE'S NOTHING LIKE A NILSON

NILSON has been specializing in Forming Equipment for over 50 years.

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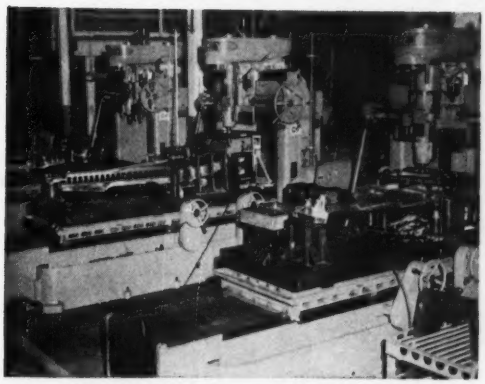

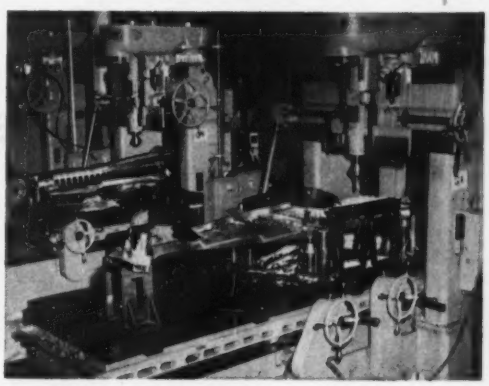

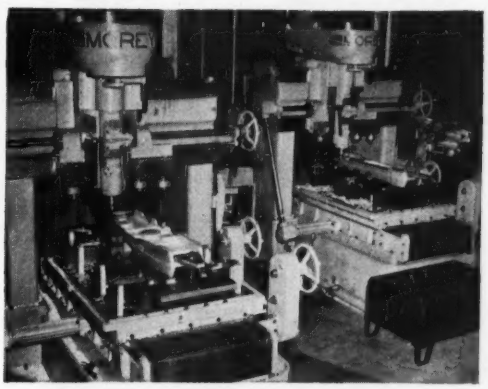

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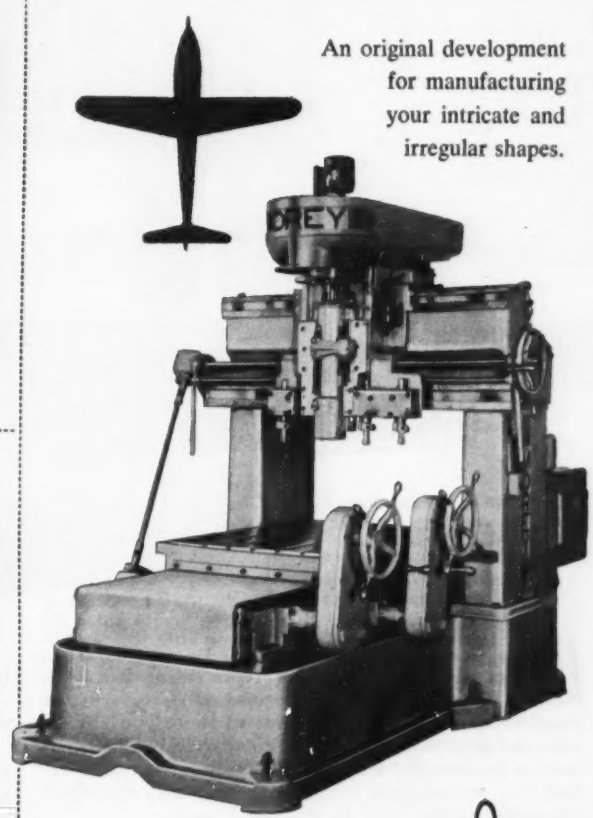

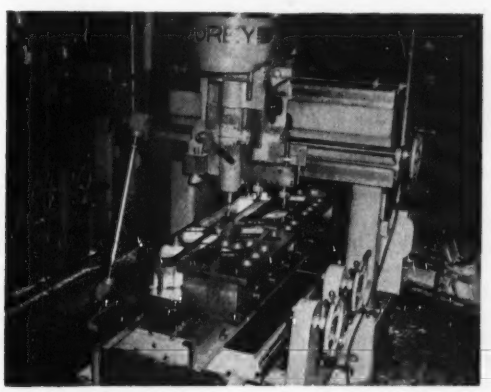

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New Taft-Peirce GRANITE SURFACE PLATE Keeps Measurements On The Level

FOR PRECISION MEASUREMENTS that require the ultimate in smooth flat surfaces, Taft-Peirce now offers something new in surface plates. A Blue-White Granite Surface Plate. Made of a granite new to toolrooms, it's harder, more wear-resistant, easier to use and care for.

SURFACE ACCURACY is not subject to distortion. Plate is free from all residual stresses. Temperature changes or shock can't warp it.

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PRACTICALLY INDESTRUCTIBLE, heavy pointed objects dropped on the surface barely powder point of impact. No humps or burrs are raised to impair accuracy. Unique grain direction running 45° to working surface of plate prevents cracking, chipping, or breaking.

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In addition to its regular line of tungsten carbide wire type plug gages from .016" to .500" diameter, The Van Keuren Company now offers a new line of *Chrome Carbide Taper Insert Plug Gages* in the range from .500" to 1.510" diameter.

Made of Carboloy chrome carbide, grade #608*, these gages offer huge savings in cost per hole gaged. Wearing qualities of the new chrome carbide material are comparable with those of tungsten carbide. This material provides the additional advantages of being much lighter and of having a coefficient of expansion close to that of steel. The finish on VK Chrome Carbide Gages will average .5 RMS or better.

Van Keuren Chrome Carbide Taper Insert Plug Gages are available in Class Y, X, XX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the 220-page Van Keuren Catalog and Handbook No. 35 containing valuable technical and engineering information on measuring problems and methods. Address: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

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VK

34th YEAR

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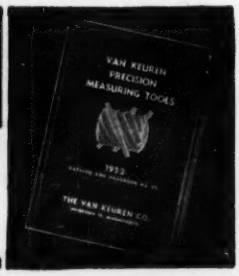

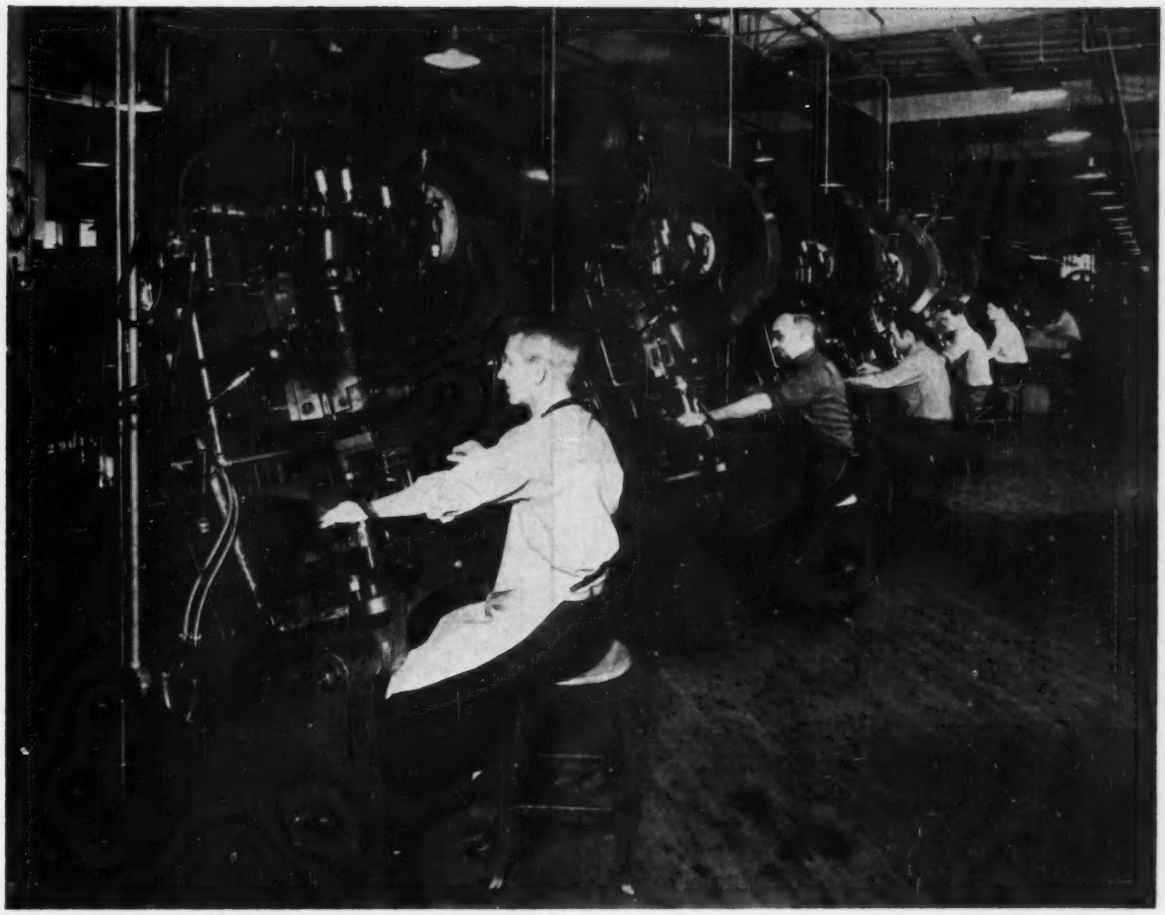

Battery of Inclinables a block long bats 'em out at Burroughs

Here is one of the largest installations of streamlined open-back Inclinable presses in the country. Fast, economical, adaptable, these FERRACUTES are cutting production costs in the Detroit Plant of Burroughs Adding Machine Company.

FERRACUTE'S new design Inclinables are available from 6 to 200 tons, providing a flexible choice, to enable you to match your selection of presses to the requirements of your job — for greater efficiency and economy.

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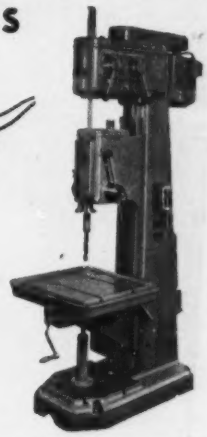

Quick changeover from job-to-job on short or long run heavy-duty drilling production is assured by easily adjustable head and table on new ALFING DRILL PRESS.

Crank raises or lowers table; headstock moves 6" up or down by hand on scraped ways. Easy-to-reach controls cut handling time, too. 9" quill-supported spindle stroke, driven by 3½ h.p. V-belt motor. Motor speed 900 rpm. Drilling capacity of 1" in steel; 1¼" in cast iron. 8 spindle speeds from 150 to 1640 rpm. Drilling feed by hand or power.

Table surface 26"x28". Scraped base plate may be used as table for extremely bulky work pieces. Distance between spindle and table, 23" max.; spindle and base plate, 25"-40". Write for descriptive literature.

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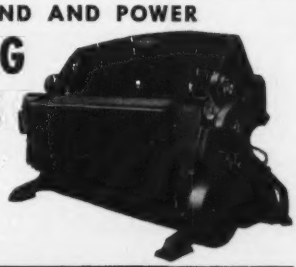
CHICAGO **BENDING BRAKES**



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Double Folder Brakes

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...PRODUCES HIGHEST PRECISION
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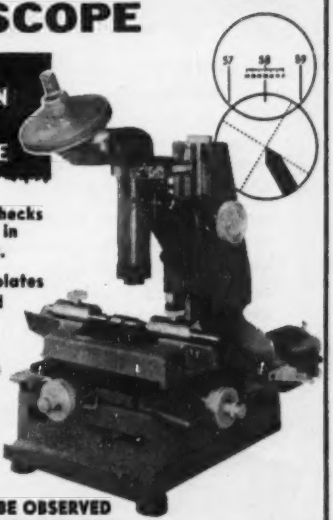

The NEW LEITZ DESIGN checks angular measurements in degrees and minutes.

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Contains Radii Templates from 21/64" to 13/16" by 1/64". Concentric circles from .010" to .280" by .010" and one blank compartment.

NOTE: TEMPLATES CAN BE OBSERVED IN 3 MAGNIFICATIONS: 10X - 20X - 30X

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JIG GRINDING ACCURACY *guaranteed**

INFINITE CONTROLLED SPEEDS 30,000 TO 65,000 R. P. M.

Easily connect jig grinder to jig borer or mill

Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

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For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

*Dependably accurate to "tenths"

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MULTI-WHEEL NUMBERING MACHINE

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AND THE FOLLOWING IMPROVEMENTS HAVE BEEN ADDED
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A SPECIALIZED CAM MILLING SERVICE . . JIG BORING SPOT WELDING . . CONTRACT PRODUCTION . . EXPERIMENTAL DEVELOPMENT

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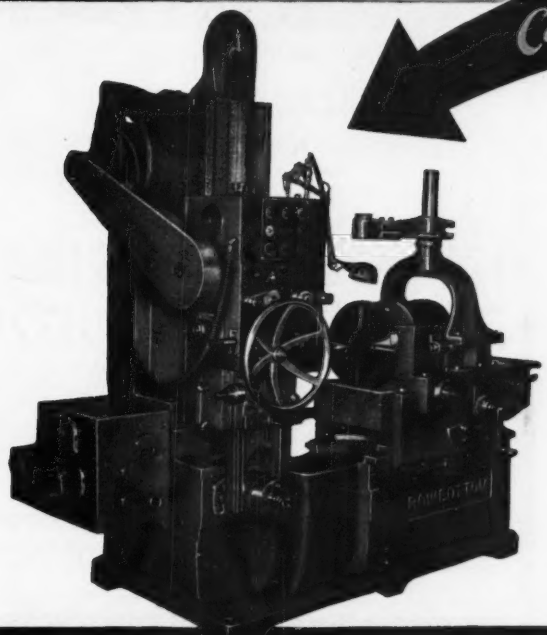

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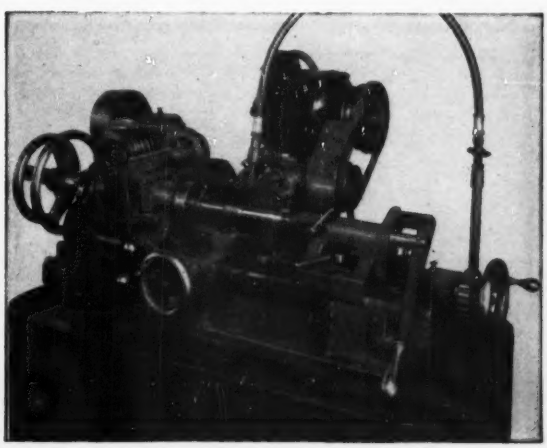

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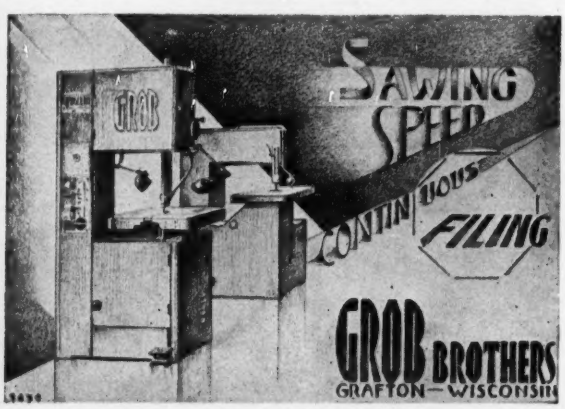
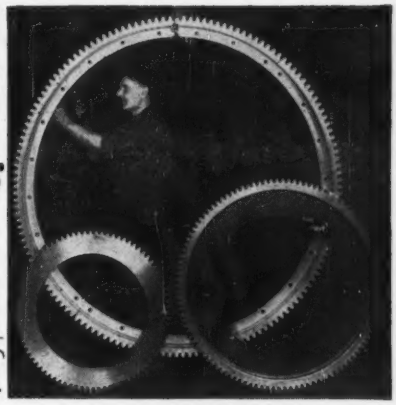


Three Finished Performers



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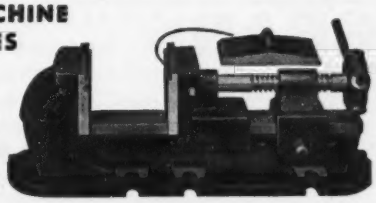

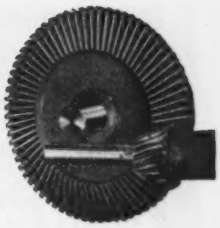

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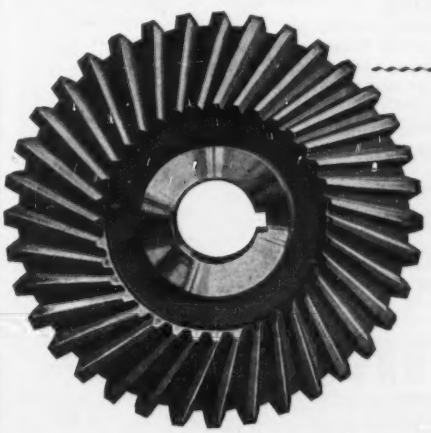

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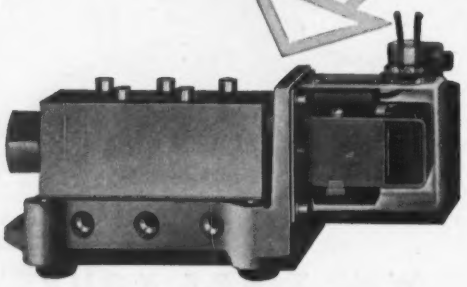

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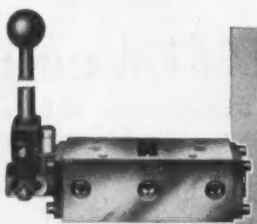

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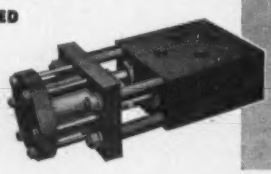

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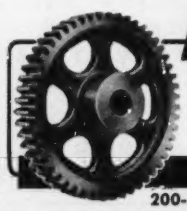

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Many are companies with problems very similar to yours.

These questions can be answered correctly because Viking people draw from over 40 years' successful pumping experience and recommend from the fastest-growing, most complete line of rotary pumps on the market. Over 600 standard models plus endless special designs. There's no compromise with Viking Pumps. We invite your questions on pumping problems.

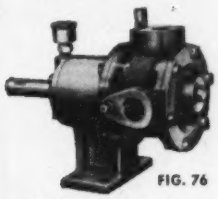

FIG. 76

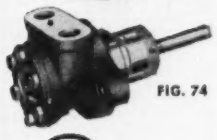

FIG. 74

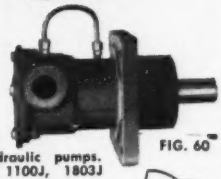

FIG. 60

Learn about the complete line of Viking machine tool coolant, lubrication and hydraulic pumps. Send for bulletins 1100J, 1803J and 303J today.

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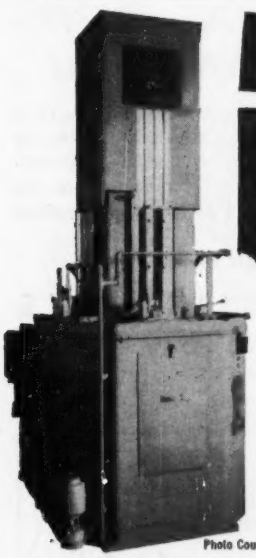

SPLIT SECOND COOLANT FLOW

with a

RUTHMAN GUSHER COOLANT PUMP

This Acme Model U-31 Broaching Machine is equipped with a Ruthman Pump.

Photo Courtesy Acme Broach Corp.

You get plenty of coolant where and when you want it with a Ruthman Gusher Coolant Pump from the moment the machine is turned on. There is no packing or priming necessary and Gusher Pumps are designed for a long trouble-free life. Write us today, we'll be glad to advise you on your coolant problems.

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"Packaged Precision"

Measures high-precision holes to fractions of .0001", with these advantages—

Here in a compact self-contained unit, you have the high precision that has found so prominent a place in the jet engine program. By unique design, Comtorplug gives true 2-point gaging, self-aligned and centered. Thus, it enables you to check any part of a hole—including very bottom—detecting out-of-round, front or back taper, bell mouth, etc.

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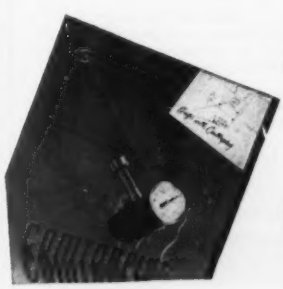
- Shows actual measurement to fractions of .0001", and is "just right" for Statistical Quality Control programs.
- No skill needed to use it accurately—built-in features and 10 minutes instruction do the trick.
- Marvellous thing about Comtorplug from production man's viewpoint is that you can put it to work in your shop without any planning, wiring, air lines or rigmarole—just a simple briefing on its use.
- Comtorplug is a rugged, shock-proof instrument. Use it for size control at the machine as well as bench inspection, wherever you produce precision holes in volume.



REQUEST BULLETIN 46

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help Maytag solve puzzling Set Screw problems

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in inch ounces
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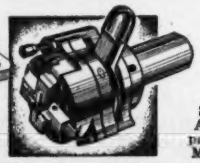

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

See our Advt on page 417 May 1953

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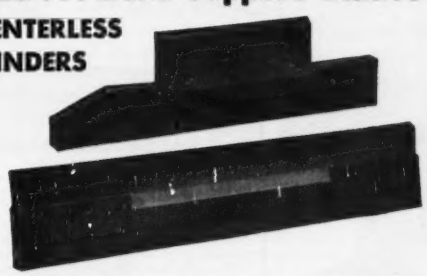
CARBIDE TIPPED...Work Support Blades for CENTERLESS GRINDERS



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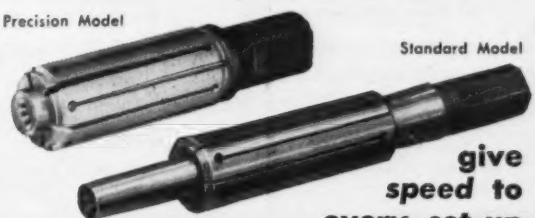
CHAMPION E-X-P-A-N-D-I-N-G MANDRELS

Precision Model

Standard Model



give speed to every set-up

The flexible sleeve, mounted on tapered arbor, expands automatically to fit the hole. Inserted by hand — no arbor press needed. Always an exact, positive, concentric fit. Locked by a single mallet blow. Unlocked the same way. CHAMPION Expanding Mandrels are used in machine shops around the world. Save time, cut production costs, whether the job calls for machining one piece or a thousand.

Precision Model has expansion range of .010". Available in regular sizes to fit holes from ½" to 3" diam. Holds work to tolerances of .0002" run-out. Guaranteed for precision grinding, turning and milling operations.

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CHAMPION *Expanding Mandrels can be made in special shapes and sizes to fit any specifications. Quotations on request. Write for descriptive folder today.*

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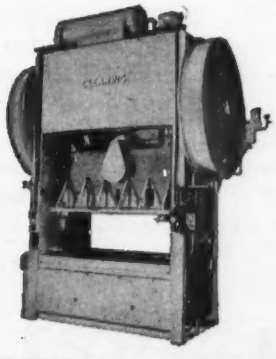

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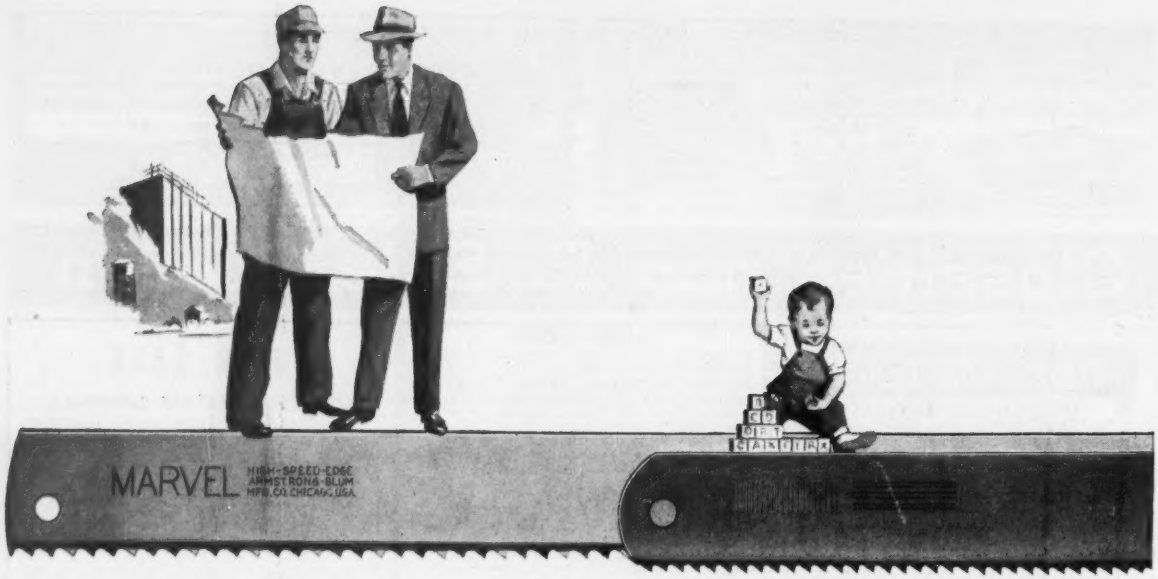

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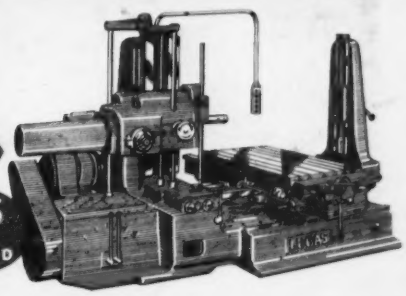

Restores worn car wheels automatically

. . . with help of TIMKEN® bearings

THIS Niles 52″ car wheel lathe, manufactured by Baldwin-Lima-Hamilton Corporation, roughs and finishes worn car wheels automatically—all in one operation! A hydraulic stylus follows a predetermined contour of the profile. Special micrometers and calipers measure and gage the wheels to determine the amount of material to be removed in re-profiling the wheel contours.

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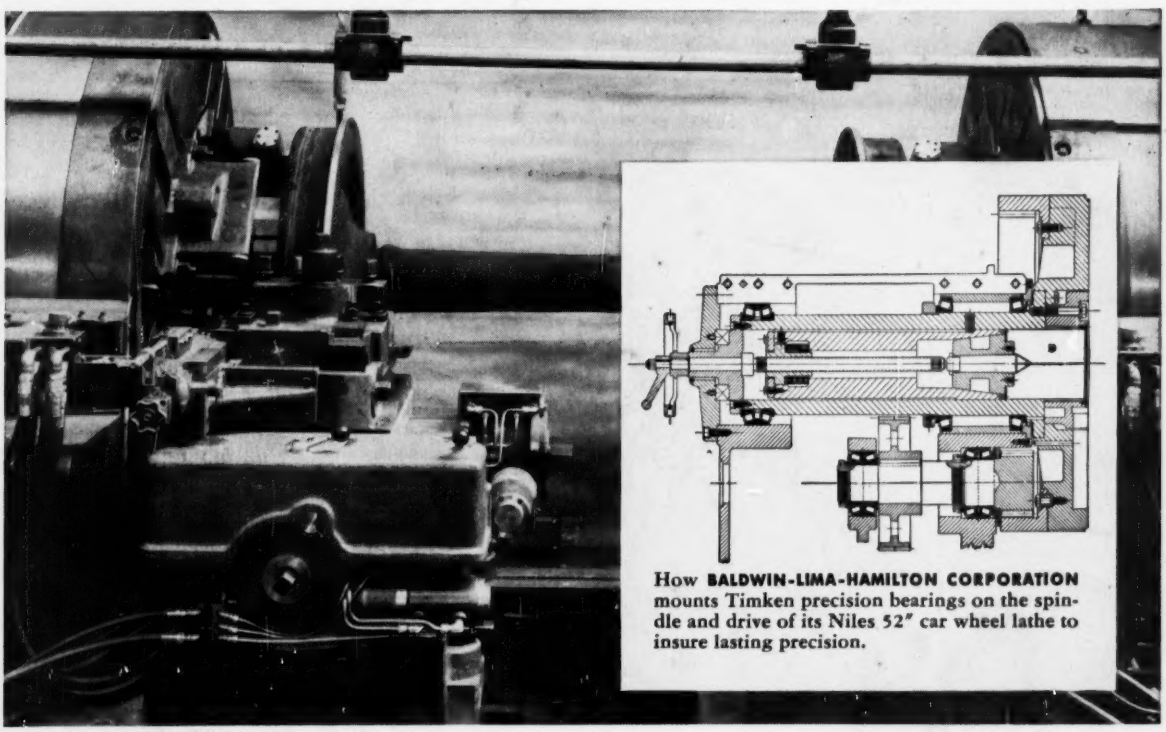
To help turn the heavy load of the wheels and axles smoothly, Timken bearings are also used in the drive. They hold shafts in alignment, insuring accurate gear mesh, longer gear life.

Timken bearings are easy and less costly to assemble. Manufacturing costs are reduced. Auxiliary thrust bearings are eliminated, maintenance is simplified.

No other bearing can give you all the advantages of Timken bearings. Make sure you have them in the machine tools you build or buy. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED — *This symbol on a product means its bearings are the best.*



How **BALDWIN-LIMA-HAMILTON CORPORATION** mounts Timken precision bearings on the spindle and drive of its Niles 52″ car wheel lathe to insure lasting precision.

MAGNIFYING GLASS INSPECTION OF EVERY ROLLER!

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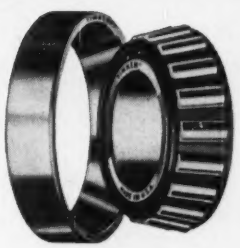

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